OCTOBER 27, 1938

FIRST AERO WEEKLY IN THE WORLD

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No. 1557
Vol. XXXIV

BRITISH AIRCRAFT INDUSTRY NUMBER

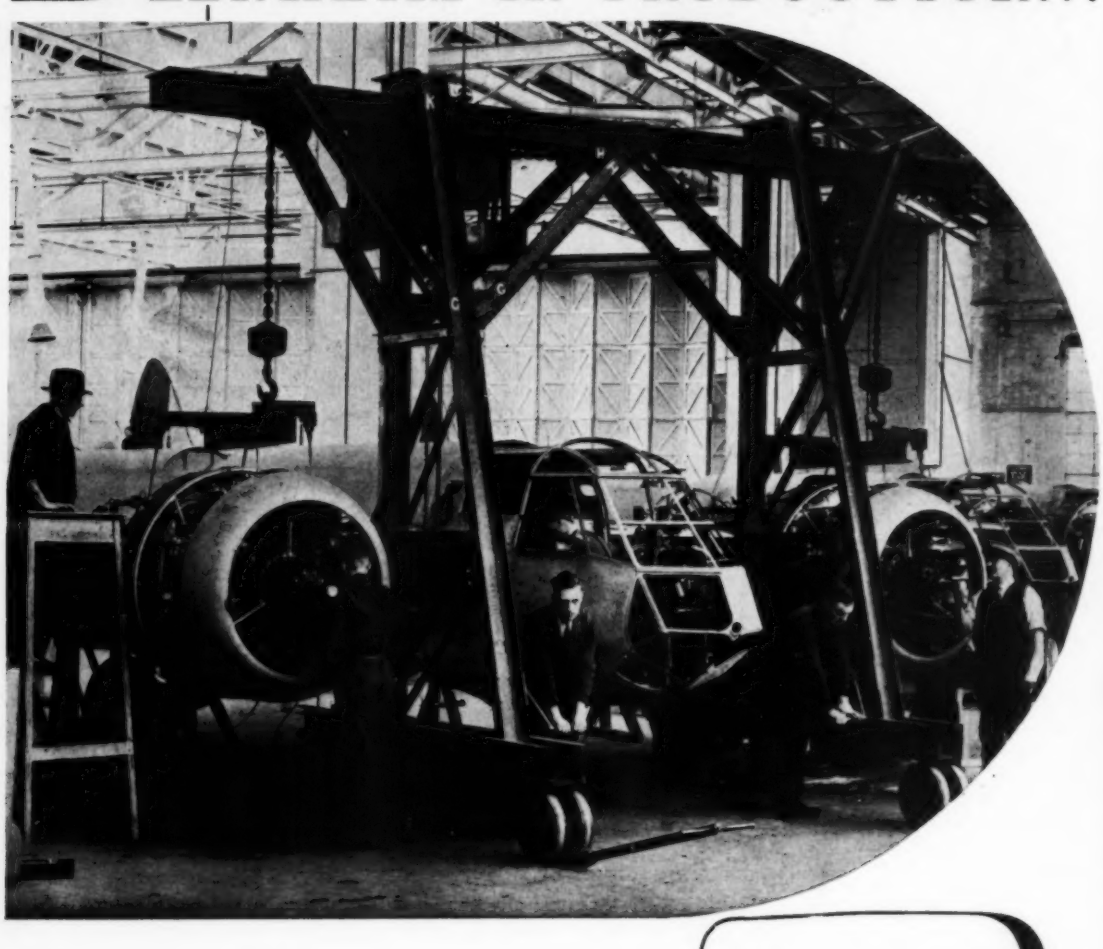
(I) Civil and Military Aircraft

HAWKER HENLEY

photograph.

ILT BY THE GLOSTER AIRCRAFT CO., LTD

BLENHEIM IN PRODUCTION...



"Bristol"

BLENHEIM BOMBER

4 The Blenheim is powered by two "Bristol" Mercury engines which are fitted to the air-frame prior to its removal from the jig by a special transportable crane. It is then ready for the attachment of the wings and tail unit.

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

Britain's Aircraft Types

IN accordance with our annual custom we publish this week a review of the types of British aircraft, civil and military, in production and service at the present time. The feature reveals the fact that, in spite of the R.A.F. expansion, our manufacturers have found time for building quite a number of civil types, large and small, both in the commercial and private-owner categories. Altogether, some 30 civil types are dealt with, ranging in size and power from the Short Empire boats of more than 40,000 lb. weight and 3,300 h.p. to small single-seater light planes of 30 h.p. or so. A good many of the types mentioned have been built in considerable quantities, and several are in regular use in most parts of the world.

Although we have had no types in service which are in the same class as the American Douglas D.C.4, to mention one example, there are several new types coming along which will in time take their place on the Empire and other British routes, and until then the existing equipment is doing excellent work. Under the new progressive scheme announced by Capt. Balfour shortly after his appointment to the post of Under-Secretary of State for Air, British manufacturers will be given the opportunity hitherto denied them of producing aircraft which will compete with the best.

The large landplanes being built by Shorts will incorporate everything that modern knowledge can suggest, and in the smaller class there will be, early next year, the new De Havilland 95 all-metal monoplane, which is expected to find a ready market not only at home but in the Dominions. There is another specification out for a four-engined commercial monoplane. At least four firms have tendered, and an announcement of the orders is expected very soon. That the specification (which is known as 15/38) is up to date is proved by the fact that the engines specified are of a type which is still on the Air Ministry's Secret List.

Air Defence

ON the Service side a journal like *Flight* is handicapped by the secrecy regulations in force. Nevertheless, our review of military aircraft in this issue covers nearly thirty types, divided into some eight main classes. Of these, the bomber category is the most impressive, numerically, with no fewer than ten different types.

Too much importance should not be attached to the fact that we are not able to include truly modern examples of two-seater fighters, torpedo-spotter reconnaissance machines, coastal defence torpedo bombers, general reconnaissance landplanes or single-seater and two-seater fleet fighters. Under modern conditions quite a long period lapses before it becomes permissible to refer to new equipment, and to this extent our review cannot convey a really true picture of the state of Britain's air defence.

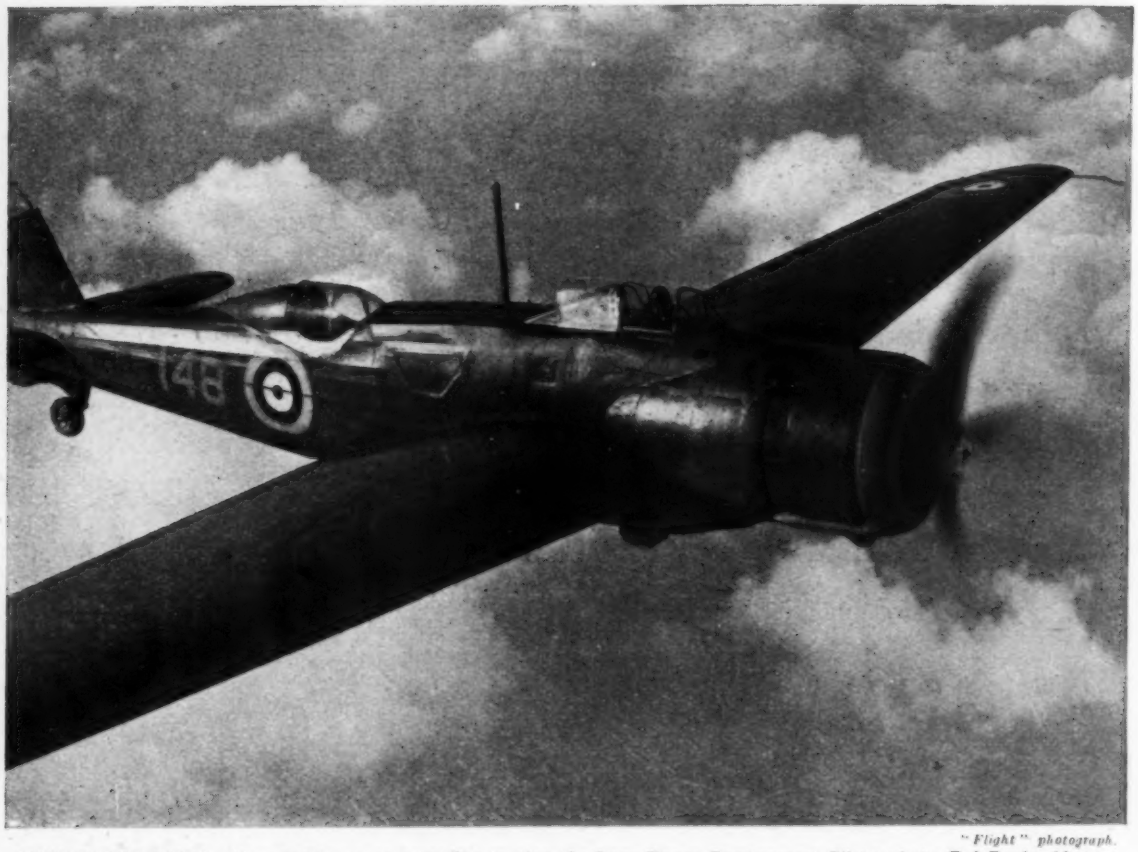
Other nations are known to have developed four-engined bombers and twin-engined fighters. It may be assumed that this country is not overlooking the possibilities of development in these directions.

In the single-seater fighter class Great Britain still leads the world. We were slow in getting going, but the machines now being produced in large numbers will bear comparison with any. And those now in the design stage will be as great an improvement on existing types as the latter were in comparison with their predecessors.

Our designers have the ability. It is up to the industry and the Government to organise production.

Production

LORD AUSTIN voiced the feelings of a large number of people when he said, at the annual dinner of the Institution of Production Engineers last Friday, that if the recent crisis had disturbed the complacency of our legislators and of the public it was a blessing in disguise. *Flight* can claim to have done as



"*Flight*" photograph.

LONG-RANGE MODS: If everything goes according to plan the Long-Range Development Flight of the R.A.F. should now be on their way to Australia with four Vickers Wellesleys. This view (actually of a machine loaned by the Air Ministry to the Bristol Company for engine tests) shows how the long-range type differs from the standard model. It will be seen that the Pegasus XXII engine is more carefully faired.

much as any journal towards calling attention to the causes for delay. By articles and comment we have done our best, within the rather severe limits imposed by secrecy regulations, to point out directions in which improvements are wanted, but it took a national crisis of first magnitude to bring home to the country in general how serious the situation really is.

The Secretary of State for Air, Sir Kingsley Wood, has a knack of quoting figures when such figures are least expected. At this dinner he stated that, whereas during the last war it took an average of 2,000 man-hours to build a service aeroplane, the figure in modern times was anything from 20,000 to 80,000 man-hours. If Sir Kingsley's figures are correct, the situation is far more serious than anyone had previously suspected. Exact figures are difficult to come by, but it has been reported that one of the French aircraft factories has succeeded in reducing the number of man-hours to a figure well below 10,000. That figure refers to a twin-engined bomber. If the best British figure is twice or three times that, it is, indeed, time we did something about it.

One should, however, be very careful in accepting estimates of this sort. Unless the basis upon which they were built is known, the figures can convey a totally wrong impression. What, for instance, is meant by saying that a certain aircraft type takes so many man-hours? Does the figure merely cover the building of the primary structure? Or does it also include the time taken in installing the equipment? Or, as a third alternative, are the man-hours that went to producing the equipment taken into account? Without knowing the answers the figures of man-hours convey practically nothing.

Reorganisation

THAT something is being done to remedy our backwardness is shown by the reorganisation of certain technical departments in the Air Ministry, to which reference was made exclusively in last week's issue of *Flight*. Even the main skeleton of the new system is not entirely finished, in that heads for certain sections have not yet been finally selected; but the new organisation is slightly different, as regards personnel, from our forecast. Under Mr. Lemon, Director-General of Aeronautical Production, will be Major Buchanan as Deputy Director-General. Below him will be, "in parallel," so to speak, the Directors of Aircraft Production (Col. Outram), Engines (Major Bulman), Armament and Instruments (Col. Disney) and three others who will be in charge of different specialised sections.

So far so good. It has been known for many months that a reorganisation of some sort was essential and, indeed, inevitable. When the official announcement is made and the names of personnel finally settled one will be in a better position to judge of the probable merits of the new system. One thing is certain: It is bound to be an improvement on the old system by which the Air Ministry took the view, enunciated by Lord Swinton, that production is the affair of the industry.

What does seem surprising is that it should have taken so long to discover the need for reorganisation. As *Flight* has previously pointed out, there must be some central organisation which can rationalise certain aspects of production. This applies not so much to detail manufacture as to the allocation of priority in raw materials,

machine tools and similar supplies. Cases frequently occur of certain materials or machines lying idle in one manufacturer's works while another is at a standstill for want of them. That sort of thing must be stopped, but whether the newly organised production department can cope with it or not will depend very largely upon the powers granted to the department.

The alternative of a Ministry of Supply for all three services is probably the logical solution, but involves greater difficulties.

Pezzicato

BRITISH aviation circles will applaud most heartily the splendid success of the Regia Aeronautica in beating by more than 2,000ft. the world's altitude record established last year by the late Sqn. Ldr. Adam, of the Royal Aircraft Establishment, Farnborough, on a Bristol monoplane with Bristol Pegasus engine. The success is the culminating achievement of a long period of research carried out by the special High-Altitude Development Section at Guidonia, and Lt. Col. Pezzi is to be congratulated on his great feat.

The recording barographs carried in the machine indicated that an altitude of 17,074 metres (56,017ft.) had been reached. The record is, of course, subject to homologation by the F.A.I., but there is no reason to believe that the official figure will differ greatly from 56,000ft.

Without minimising the value of the research work done at Guidonia, one may also pay a well-earned tribute to the two firms concerned in the record flight, the Piaggio engine used was a very special one, and it may safely be assumed that it had a multi-stage supercharger. The really interesting feature of the Caproni aeroplane used for the flight is that it was provided with a pressure cabin, so that Lt. Col. Pezzi was not handicapped by having to wear a cumbersome pressure suit (much more euphoniously called *scaphandre* by the French).

Details are, not unnaturally, being withheld by the Italian authorities for the moment, and so one does not know for what pressure difference the cabin was designed. It is hardly likely that it represented ground pressure, and probably the pressure maintained was one not too uncomfortable for a trained pilot. At a guess one would say that it probably corresponded to the pressure at 20,000-25,000ft.

Adding Lightness

WHILE making the best use he can of the structural materials available at any given time, the aircraft designer is secretly hoping for the day when the metallurgist will provide him with that new metal of his secret dreams, which shall be as strong as the strongest steel and as light as magnesium. Possibly that was one of the reasons for the large attendance at the R.Ae.S. lecture by Col. R. le Cœvre last Thursday. The distinguished French lecturer had chosen for his subject, "The Use of Light Alloys in Aircraft Construction," and doubtless the original French text contained much valuable information. It is to be feared, however, that in the translation (which had to be done hurriedly, owing to the late arrival of the French original) some of the subtler meanings were lost or misunderstood. At any rate, some portions of the paper seemed to contradict other portions, and at times the wording was confused, not to say confusing.

Quite unmistakable, however, were the lecturer's enthusiasm for light metals and for their assembly by welding rather than by riveting. The impression created was that they have progressed rather farther in France than in this country with the application of aluminium-magnesium alloys to aircraft construction.

We are a conservative lot, and it may be that our fear of corrosion has tended to overshadow the attractive features of magnesium alloys. Even in the case of duralumin, we have, perhaps, gone to extremes in our anti-corrosion measures, such as, for example, removing sheet covering after drilling the rivet holes so that the holes can be protected by anodic treatment before the sheet is finally returned and riveted into place. That principle has been applied rather regardless of the purpose for which the aircraft is intended, and it is not until recently that the regulations in this respect have been loosened for land-going aircraft.

Coastal Defence—An All-purpose Type?

THOSE who had come to regard the general reconnaissance landplane as a comparatively small, low-powered machine, as typified by our present standard type, the Avro Anson, must have received something of a jolt when it was announced that the 200 Lockheed 14s ordered from America were to be employed on G.R. duties. The Lockheed has about 2,000 h.p., and is comparable in many respects with our new twin-engined bombers.

A machine of this calibre scores over a lower-powered type on range, speed and, what is more significant, carrying capacity, for the "14" obviously possesses great striking power as a bomber, whereas the Anson (and this in no way reflects on its efficiency, for it has less than half the power of the Lockheed) can accommodate only two 100 lb. bombs and a few twenty-pounders.

The potentialities of machines like the Lockheed suggest the adoption of an all-purpose coastal defence machine—a high-powered twin-engined type fitted for long-range reconnaissance, patrol and convoy work, bombing and torpedo dropping. The twin-engined torpedo bomber would be something new so far as this country is concerned, though machines of this sort have been developed abroad over a period of years. Our hypothetical coastal defence machine might profitably be designed for interchangeable wheel or float undercarriage.

Fleet Fighters

IT would appear—and it is logical that it should be so—that the aircraft carrier will be the last stronghold of the biplane. Although it is likely that within two or three years all Fleet machines, excepting specialised catapult types, will be monoplanes (the trend has started with the Skua fleet fighter dive bomber), biplanes are likely to be operating with the Fleet for some time to come. No replacement type has yet been announced for the Shark and the Swordfish torpedo spotter reconnaissance types, and what may be more significant, the Gloster Gladiator has been developed into a Fleet fighter.

Gladiators would be very acceptable as replacements for the Nimrods (just as the Skua will be welcomed because it represents such an advance in performance as compared with the Osprey), but it must be assumed that they would be "interim replacements," for their performance can hardly compare with that of the new Cyclone-engined Brewsters on order for the U.S. Navy. Admittedly, these Brewsters are only for service test, and the Grumman biplanes (corresponding to Major Williams' aerobatic *Gulfhawk*) are likely to remain standard for some time to come. But at least the monoplanes will provide some valuable data.

DIARY OF FORTHCOMING EVENTS—PAGE 366

PITY the POOR D

Some Sidelights on the Conception of a Military Aeroplane

"*Flight*" photo

OUTSIDE aeronautical circles there is considerable lack of appreciation of the actual circumstances in which aircraft, and particularly military aircraft, are produced. "Why don't our designers do so and so?" is a remark which recurs with surprising frequency in the many letters we receive from well-meaning enthusiasts who think they see obvious ways of improving aeroplanes.

They forget that, in military aircraft at any rate, the percentage of weight and other requirements over which the aircraft designer has any direct control is relatively small. Possibly, therefore, the following outline of the organisation and working of the complicated machinery which produces aircraft for the R.A.F. may serve to give a clearer appreciation of the difficulties with which the path of progress is strewn; it should also assist the reader to appreciate what lies behind the facts and figures given in the reviews of aircraft in this Special Number.

It is one of the tasks of the Air Council to decide, from strategical and tactical considerations, the classes of aircraft wanted for the varied duties of the Royal Air Force. The decision is, of course, based upon the views and experience of the squadrons of the R.A.F. and on tactics worked out at the R.A.F. Staff College at Andover. The different technical departments of the Air Ministry advise on what is and is not possible in the way of speeds, ranges, military loads and so forth, bearing in mind the types of engine available at any given moment, or which may be counted upon to have become available by the time a new aircraft class has been established.

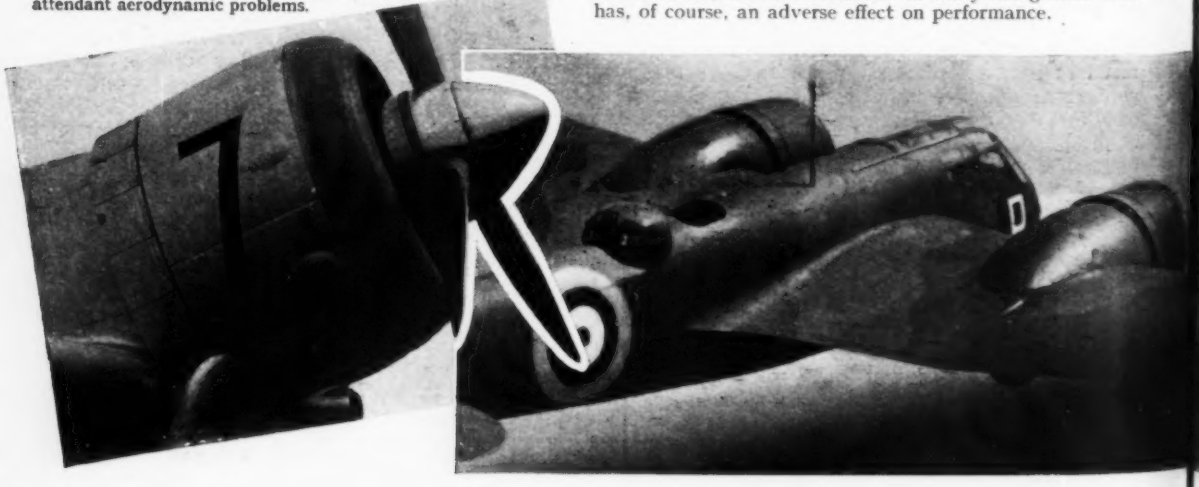
A.M. Specifications

On a basis formed by such considerations the Air Ministry departments draw up specifications which stipulate the type and weight of the military equipment to be carried, the minimum range which the machine must have with that military load, and certain minimum requirements as to speed, climb and ceiling. In most cases the type of engine is also stipulated—and, of course, the number of engines to be fitted.

When the specifications reach the "approved" firms in the aircraft industry to which alone they are issued, the chief designer and his staff examine the requirements and begin to plan what is the best solution of the many conflicting desiderata, taking into careful consideration the past experience of the staff, the equipment of the works, and the availability of workers in the many specialised branches of aircraft manufacture. Every aeroplane ever built, at any rate, every military aeroplane, has been a compromise. Only in aircraft constructed for racing or record-breaking can the designer go "flat out" for one particular aspect of performance; it may be speed, it may be range, or it may be ceiling.

In military aircraft, however, the designer dare not overemphasise any one aspect at the expense of others, except in so far as the single-seater fighter is concerned, and in this he *can*, to some small extent, stress the importance of speed, because his power reserve is usually so great that climb and ceiling follow almost automatically. Even in fighters, however, he is handicapped by considerations of things other than speed. For instance, the very powerful engine used needs a lot of fuel for even a short-duration flight at full throttle; the guns, of which there may be eight, run away with a very great deal of weight for themselves and their ammunition. These two factors alone tend to make the single-seater fighter larger than it need otherwise be, and the extra size to carry the greater load has, of course, an adverse effect on performance.

A few reminders that the designer of a military aeroplane has to worry about more than two wings, a fuselage and a tail unit: here, among other things, are cowlings, turrets, radio masts, air-cooling intakes and outlets, and retracted undercarriage fairings—all with their attendant aerodynamic problems.



R DESIGNER!

By The Editor

The problem which confronts the designer when he starts to plan out a machine to an Air Ministry specification is one of getting the stipulated military load, including crew and their quarters, into the smallest possible compass. If take-off runs and landing speeds are to be kept down to reasonable limits, the loaded weight must determine the wing loading and thus the wing area. In recent years the use of slots and flaps as aids to lift has made it possible for the designer to increase his wing loadings considerably, but as these fittings produce drag as well as lift, and a greater percentage increase in drag than in lift, they do not help the rate of climb or the ceiling, so that, in some classes of aircraft, wing loading may be limited by these considerations rather than by landing speeds.

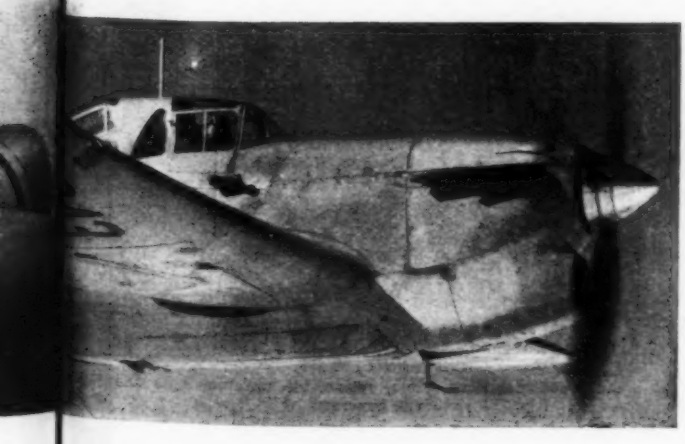
Having added together the weights of his power plant, fuel, oil, military load, equipment and crew, the designer is rather in the position of the servant girl who was told her duties throughout the 24 hours, "... and the rest of the time is your own." There is so little left, over which he can exercise control, that a designer has to be quite remarkably clever if he is to beat his competitors in a given specification by more than a very small margin. This may explain the fact that usually there is very little to choose between two competing types by different manufacturers. Particularly does it apply to performance. Often the ultimate choice of a type for quantity production is decided not so much on superiority in performance as on its military qualities, such as fighting view, room to change places, absence of blind spots and general accessibility of the equipment.

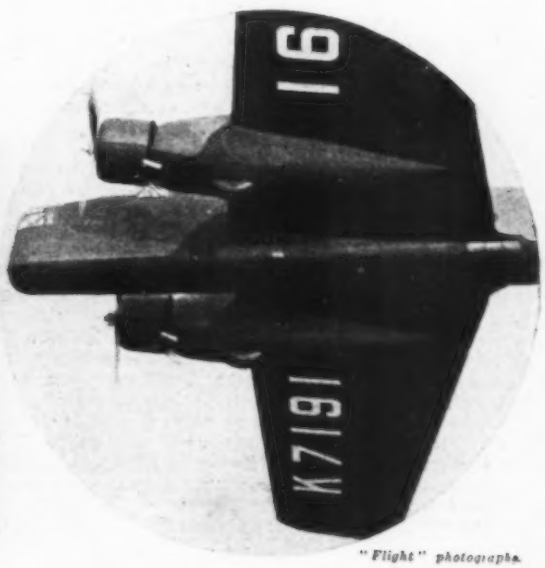
Occasionally an aircraft constructor takes the bit between his teeth and produces an aeroplane which does not conform to any particular specification, but which has outstanding qualities in certain directions. The classic example of that is, of course, the Fairey Fox, produced many years ago. Mr. C. R. Fairey was not impressed by contemporary specifications and designs, and he produced the Fox and fitted it with a Curtiss D.12 engine. The machine was slightly cramped in its accommodation, and the engine did not conform in every way with regulations to which British engine designers had to submit at the time, but it did have a remarkable performance. So good, in fact, that the Air Council could not ignore it, and orders of considerable magnitude (for those days) were placed. When an aircraft constructor produces such a machine, without the blessing or assistance of the Air Ministry, the result is known as a private venture, and the aeroplane is known as a "P.V. machine." There have been a good many examples of P.V. aeroplanes being produced and afterwards being adopted by the Air Ministry.

"Mock-up" Conferences

After settling in a general way the main lines on which he will work, the designer submits his estimates to the Air Ministry with an outline general arrangement drawing of the proposed design. If his firm has managed, sometimes perhaps by being a little optimistic, to convince the Air Ministry that the suggested design promises well enough, a "mock-up" is built. Usually this is in the form of a full-size model of the central part of the aircraft, with fuselage complete and wings extending out to the engines if the type is twin-engined. The model is made up of laths and cardboard or brown paper, and it is quite surprising how realistic it can be. No drawing could possibly give the same idea of how the finished machine will shape in the matter of roominess, accessibility, view, and so forth.

Some weeks afterwards, when all the people concerned can spare the time on the same day, a flock of Air Ministry experts descends upon the "contractor," as the aircraft manufacturer is called in Air Ministry parlance. Each man has some particular feature or aspect to watch. One will fight to get his guns or bomb gear in a certain place. Another will insist that his electrical equipment must go there and nowhere else. A third must have his particular gadget just where one of the others wanted to place his,





"Flight" photographs.

"Flight" photographs.

and it takes a great deal of tact and good will on all sides to arrive at a reasonable compromise. Until comparatively recently it was almost literally true to say that the only people who were never consulted were the people who were to fly the machines. Now, however, that anomaly is being to some extent rectified by posting serving officers of the R.A.F. to the works of the larger manufacturers in order that the needs of the Service, as distinct from the opinions of the Air Ministry, may be given at least *some* attention.

In the meantime, the designer and his staff have been hard at work planning out the general aerodynamic design of the machine and the general type of structure to be used in fuselage and wings. The drawing office has begun work on the detail drawings. From past experience the designer knows within a little what his various component weights are going to be. If he was a little optimistic in one direction he was probably unduly pessimistic in another, and usually the total structure weight is somewhere close to the figure originally estimated. As the detail drawings progress, detail weight estimates can be made, and if they show that the suggested type of structure is likely to work out too much in excess of the estimate, it may be necessary to redesign certain parts or components.

"Stressing"

While the detail drawings are being prepared, the stress department will have been at work on "stressing the machine." This expression does not, as the uninitiated might think, indicate that all the people in the drawing office go and stand on the wings. It is slang for carrying out calculations of the stresses which can conceivably be imposed upon any given part of the structure in any manœuvre.

From the stress calculations the material and physical dimensions of the part in question are determined. It is at this point that the clever designer scores. He will know from past (and often bitter) experience that there is usually a considerable difference in weight between the prototype aircraft and the production machine. Air Ministry specialists will probably think of a few extra gadgets they had overlooked at the time the specification was drawn up, or the political situation may have changed in the meantime, and longer range will be required. Thus the sayings and doings of a European dictator may quite well have their effect in the stress departments of every British aircraft constructor. The clever designer allows for this, and where a 16-gauge sheet would really do the

Fore and aft—two more designer's problems: leading-edge cooling intake ducts; tail turrets.

work, he uses 14-gauge. Thus, by the time the machine goes into production (if it ever does) he does not have to redesign all his details. The price he pays is a slight increase in structure weight, but probably this will not have any very marked effect on performance.

In the aerodynamic design of his machine the designer will again have to choose one compromise after another. If he were designing for performance and for nothing else, his task would be comparatively simple. But he is not designing a nice, clean aeroplane to suit his own ideas. His problem is to design around the specified military load the aeroplane with the best possible performance. In other words, he must strike a useful compromise between aerodynamic efficiency and military utility. The two do not go too well together. The one demands smooth lines and no excrescences; the other, windscreens through which the pilot can see, gun turrets which give a free field of fire, bomb-aimer's positions which give a view of the target and from which the bomb release gear can be operated at the right moment, without a second's delay.

The Low-wing Cult

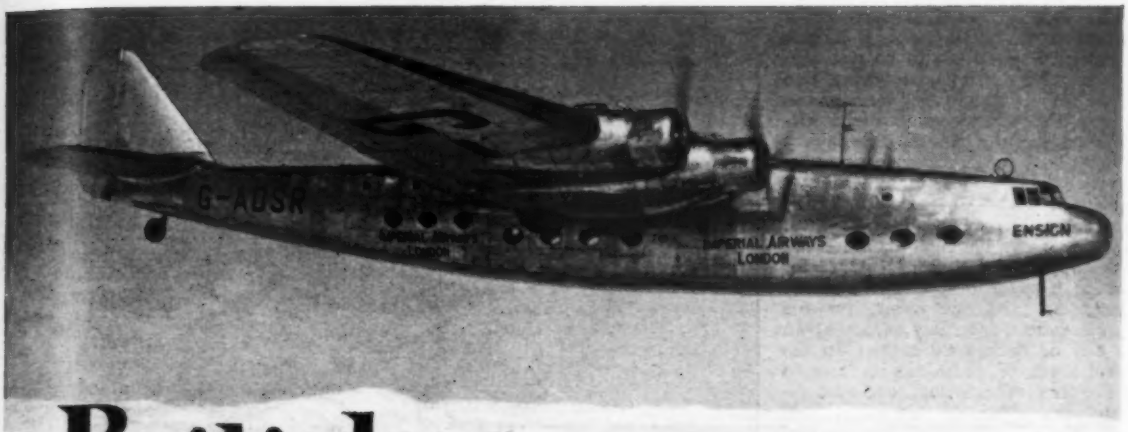
One is often asked why the low-wing cantilever monoplane arrangement has become almost universal during the last few years. The answer is that with the introduction of the retractable undercarriage the low wing position makes it possible to employ an undercarriage of short length, which can comparatively easily be tucked into the wing when retracted. In a high-wing monoplane the distance from the ground to the wing is so great that the legs of the undercarriage would have to be very long and would, therefore, present serious problems and add extra weight. That it *can* be done is shown by the Armstrong Whitworth *Ensign* class of commercial aeroplane.

A practical advantage of the low wing position from the maintenance and servicing point of view is that the engines are fairly close to the ground, so that tall trestles and built-in leading edge hinged platforms are not necessary. The height is determined by the airscrew clearance, or in some cases by the ground angle of the machine.

(*Concluded on page* 365.)

"Flight" photograph.

More considerations—slots, retractable undercarriages and v.p. airscrews.



British Commercial Aircraft

The first of the Armstrong Whitworth Ensign class, *Ensign* itself, has just gone into service with Imperial Airways. Fourteen of these enormous landplanes have been ordered.

A Detailed Review of Current Types

(Illustrated Mainly with "Flight" Photographs)

AIRSPEED

ONE of the first machines to be built according to the modern formula in this country, the Airspeed Envoy is in use over here on internal airlines and also abroad, notably in Australia and Japan. The Series III type, which is the latest of the Envoys, is normally fitted with Armstrong Siddeley Cheetah IX moderately supercharged engine, with which it has a cruising speed, at optimum altitude, of 170 m.p.h.—a figure which is often forgotten when the performance figures of more recent transport machines from abroad are being quoted.

In its newer forms the Envoy is fitted with split trailing-edge flaps which extend from aileron to aileron and can be set to any angle up to approximately 80 degrees. The only fault which could be found with the original Envoys concerned the flat angle of approach, and this criticism certainly cannot be directed against the Series III type when the flaps are in the fully down position. The undercarriage is, of course, retractable, and the particular mechanism used is one of the most reliable yet devised and has been fitted to Airspeed machines ever since the Courier was produced in the company's early days.

The structure of this cantilever monoplane is of wood with a ply-stressed wing and semi-monocoque fuselage. Since the machine is intended for comparatively small-scale operations, there is accommodation for only one pilot, and when a radio operator is carried he takes one of the seats behind the forward bulkhead.

AIRSPEED ENVOY III data:—Span, 52ft. 4in.; length, 34ft. 6in.; all-up weight, 6,600 lb.; weight empty (including electrical and standard equipment and normal upholstery), 4,341 lb.; wing loading, 19.5 lb./sq. ft.; power loading, 9.4 lb./h.p.; maximum speed at altitude, 203 m.p.h.; cruising speed at 62½ per cent. power at 10,000ft., 170 m.p.h; service ceiling, 22,000ft.; single-engined ceiling, 6,250ft.; cruising range with normal tankage, 620 miles; cruising range with auxiliary tankage, 1,000 miles.

Makers:—Airspeed (1934), *Ltd., The Airport, Portsmouth, Hants* (*Portsmouth* 2444).

The Series III Envoy cruises at 170 m.p.h. with two Cheetah IX engines. This particular machine belongs to the King's Flight.

ARMSTRONG WHITWORTH

LAST week the first example of the Imperial Airways' fourteen Armstrong Whitworth Ensign class transports went into preliminary service on the Paris run. Actually this first machine is one of those intended for the overland service to India, and when experience has been gained and others of the class have been

delivered it will go on to this route.

The A.W.27, as this machine is officially designated, is the largest commercial landplane to be put into regular service. It is, moreover, one of the very few high-wing monoplanes among transport types, Imperial Airways having decided on this layout in order to give the passengers a range of view which is not obtainable in low-wing machines. The Ensigns, which are each powered with four 880 h.p. Siddeley Tiger IX engines, are being laid out in two versions. One, for European operations, will carry forty passengers, and the other, for the Empire routes, will carry twenty-seven by day or twenty by night. In the Empire version there are three main passenger compartments, one immediately aft of the control cabin, and two others aft of the monumental centre section. As in the case of the Empire boats, a promenade deck has been arranged below the wing between the forward and the centre cabins.

The wing of the Ensign is built round a single rectangular box spar in which the top and bottom sides are of corrugated sheet, and the entire structure is stabilised by means of tubes arranged in diamond formation. Metal covering is used for the leading edge, but aft of the spar, where the wing is built up of light alloy sections, fabric covering is used. Split trailing-edge flaps, actuated by four hydraulic jacks, extend between the ailerons and the fuselage. The latter is a monocoque structure, the length of which —110ft.—enters the realm of marine engineering. It is more or less conventional, involving the use of transverse frames, longitudinal stringers, and a metal covering. The top of the fuselage is recessed to take the wing spar, and the area concerned is, of course, substantially strengthened to take the flying stresses.

The Ensign is somewhat unusual, according to modern practice, since the fin and rudder assembly is not duplicated. Apparently the length of the fuselage and the ample area of this assembly give good directional stability. Most interesting of all, perhaps, is the engineering feat involved in designing and manufacturing an undercarriage retracting gear to suit a high-wing machine of such dimensions; the hydraulic jacks in the undercarriage are 7ft. long in their extended position, yet the raising operation takes only 1¼ minutes.

ENSIGN Data.—Span, 123ft.; length, 110ft.; height, 23ft.; wing area, 2,443 sq. ft.; all-up weight, 48,500 lb.; weight empty, 33,000 lb.; payload, 9,500 lb.; wing loading, 20 lb./sq. ft.; power loading, 13.8 lb./h.p.; span loading, 3.2 lb./sq. ft.; maximum speed (sea-level), 182 m.p.h.; maximum speed (7,000ft.), 205 m.p.h.; cruising speed (7,000ft.) on two-thirds power, 170 m.p.h.; stalling speed, 66 m.p.h.; initial rate of climb, 700 ft./min.; rate of climb at 10,000ft., 500 ft./min.; service ceiling, 16,500ft.; range at cruising speed, 850 miles; price, £52,000.

Makers:—Sir W. G. Armstrong Whitworth Aircraft, Ltd., Coventry (*Coventry* 60071).

The Avro 652 transport in its later form—actually one for the Egyptian Government. The well-known Anson was developed from the 652, two of which were used by Imperial Airways.

AVRO

THE Avro 652 high-speed commercial monoplane may be considered as the type from which the now well-known Anson was developed, and it was, in fact, the first low-wing commercial monoplane to be built at the Newton Heath works. Two of these were originally ordered and flown by Imperial Airways who, however, now require types of a rather greater seating capacity for all their services. These two are now in good use at Air Service Training, Hamble, for navigation and wireless instruction, while more recently the type has reappeared and is used by the Egyptian Government. In its latest form the general layout is more similar to the Anson, without, of course, this machine's rear gun turret.

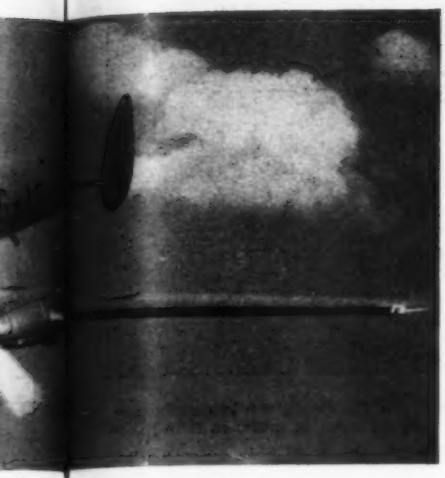
The 652 has, like every machine produced by the company since 1929, a fuselage of welded steel construction. The covering is of fabric on wood fairing, while the nose is panelled with electron sheet. The wing is cantilever and is built in one piece with two box-section main spars and ply-wood covering. The tail unit is cantilever, and of similar construction. It is normally fitted with two Siddeley Cheetah IX moderately supercharged engines with fixed-pitch airscrews. Mechanical operation is employed for the retraction of the undercarriage. At the time when the 652 first appeared flaps were not usual, but the later production Ansons have all been so fitted. Six passengers are normally carried, with a crew of two, the second pilot acting as radio operator.

AVRO 652 Data.—Span, 56ft. 6in.; length, 42ft. 3in.; all-up weight, 8,000 lb.; weight empty, 5,550 lb.; maximum speed at sea level, 175 m.p.h.; maximum speed at 7,000ft., 195 m.p.h.; cruising speed at rated height, 160 m.p.h.; stalling speed, 62 m.p.h.; rate of climb, 750 ft./min. (905 ft./min. at rated altitude); service ceiling, 19,500ft.; absolute ceiling on one engine, 6,000ft.; normal range with full load, 600 miles; maximum range with standard tanks, 845 miles.

Makers: A. V. Roe and Co., Ltd., Newton Heath, Manchester, 10 (*Collyhurst* 2731).

CUNLIFFE-OWEN

THE first of the new British Burnellis is now almost finished at the Southampton Airport works of Cunliffe-Owen Aircraft. Basically the design of the machine is similar to that of earlier Burnellis built in America, but the new layout permits the greatest possible amount of lift with the least drag to be obtained from the aerofoil-section fuselage.



Probably the most efficient aircraft in the world, the D.H. Albatross flies at 210 m.p.h. on a cruising output of 1,302 h.p. from the four Gipsy Twelve engines—this while carrying a disposable load of 11,638 lb. in the case of the transatlantic version, which is shown here. The range at the same power and loading against a 40 m.p.h. headwind is 2,500 miles.

Furthermore, the pilot's compartment has been arranged so that, with the help of a carefully designed windscreen and cabin top, the operating crew will have an almost perfect view in all essential directions. Only the two Perseus engine cowlings are likely to form an obstruction over certain areas, but the pilot's position is such that he can to some extent see over these.

The new machine is of all-metal stressed-skin construction, with two-section ailerons extending over almost the entire trailing edge, with flaps at the roots and an additional flap at the rear of the lifting fuselage. Mr. Clyde Pangborn has been in consistent charge of the design and development, and he will be carrying out the test flights when these are started.

No performance or other figures are yet available, but it is hoped that the machine will have an exceptional performance in the way both of speed and weight-lifting capacity.

Makers: Cunliffe-Owen Aircraft, Ltd., Southampton Airport, Eastleigh, Southampton (Eastleigh 87276).

DE HAVILLAND

THE long-awaited change in the official subsidy attitude towards transport flying has at last given the De Havilland Aircraft Company the opportunity of going ahead with the production of an all-metal commercial machine according to the modern formula. This is the twin-engined D.H.95 and the first of the series is rapidly taking shape at Hatfield.

The 95 is a twelve/seventeen-seater medium-size passenger machine in which there will be accommodation for as many as twenty passengers when it is used for short-haul operations. For various reasons the high-wing design has been favoured, with, of course, a retractable undercarriage. The two 850 h.p. Bristol Perseus XIIC sleeve-valve engines will be fitted with full-feathering Hydromatic airscrews. In a general way the structure follows conventional stressed-skin design. It will have slotted flaps. The D.H.95 should be flying early next year, and a large batch of them is being laid down for use not only on the newly subsidised internal services but also abroad, where larger subsidies have popularised types of similar performance and layout.

Provisional D.H.95 data.—Span, 68ft.; length, 50ft. 3in.; disposable load, 5,000 lb.; cruising speed, 200 m.p.h.; rate of climb, 1,500 ft./min.

The D.H.91, or Albatross, which is undoubtedly the most efficient aeroplane of comparable size in existence to-day, is being produced in two forms. One of these is for long-range mail-carrying work across the Atlantic, and two examples have been ordered by the Air Ministry; the other is a twenty-six- seater passenger-carrying machine, of which five have been ordered by Imperial Airways. Examples of each are now ready for delivery and the rest of the order will be completed shortly.

The structure of the Albatross is a particularly interesting application of new ideas in the use of wood, and to some extent follows that of the well-known Comet, on which type the design may be said to have been based. The thin-section cantilever wing is built up of two spars with spruce-strip covering; the fuselage is a particularly ingenious monocoque structure in which a balsa wood sandwich is used to support the plywood. The four engines are Gipsy Twelves, which each give a maximum of 525 h.p. for take-off, and the airscrews are of the constant-speed type.

The mail-carrier version is designed for an all-up weight of 32,498lb. and the passenger type at 29,500 lb. Minor differences, apart from those involved in tankage arrangement, are to be found in the two types; the former, for instance, has normal split flaps with Dunlop anti-icing equipment along the leading edges, while the latter has slotted flaps. Both, of course, have electrically retractable undercarriages.

Provisional D.H. ALBATROSS data (mail-carrier version).—Span, 105ft.; length, 71ft. 6in.; all-up weight, 32,498 lb.; weight empty, 20,860 lb.; disposable load, 11,638 lb.; payload, 1,000 lb.; wing area, 1,078 sq. ft.; wing loading, 30.20 lb./sq. ft.; power loading, 15.50 lb./h.p.; maximum speed, 231 m.p.h. at 8,750ft.; cruising speed, 212 m.p.h. at 62 per cent. power; cruising range, 2,500 miles against 40 m.p.h. head wind, and maximum range, 3,300 miles.

D.H. ALBATROSS data (passenger version).—Span, 105ft.; length, 71ft. 6in.; all-up weight, 29,500 lb.; weight empty, 21,230 lb.; disposable load, 8,270 lb.; payload, 4,188 lb.; wing area, 1,078 sq. ft.; wing loading, 21.5 sq. ft.; power loading, 12.4 lb./h.p.; maximum speed, 234 m.p.h. at 8,750ft.; cruising speed, 210 m.p.h. at 11,000ft. on 62 per cent. power, and cruising range, 1,100 miles.

For many years, as a logical successor of the orginal Dragon, the Rapide (D.H.89) has had a reputation for making air services almost, if not entirely, self-supporting. It is the most economical medium-sized transport aeroplane in existence to-day, and its original development was the direct result of the fact that our own internal airlines had to fly by themselves. An enormous number of them are used all over the world, and the De Havilland Company has reason for looking on the type (if old-fashioned when seen through superior eyes of heavily subsidised nationals) as the most successful one they have ever produced.

De Havilland RAPIDE data.—Span, 48ft.; length, 34ft. 6in.; all-up weight, 5,550 lb.; weight empty, 3,260 lb.; payload, 1,472 lb.; wing area, 336 sq. ft.; wing loading, 16.52 lb./sq. ft.; power loading, 15 lb./h.p.; maximum speed, 157 m.p.h.; cruising speed (on 75 per cent. power), 140 m.p.h., and cruising range, 556 miles.

Another type resulting from the de-

More than two hundred D.H. Rapides are in use throughout the world—a number which is explained by the fact that the machine is the most economical of its size

mands of unsubsidised operators is the D.H.86, which may be considered as an enlarged four-engined version of the Rapide. Here, again, examples are doing good work both in this country and abroad. In standard form it is a fourteen-seater with four Gipsy Six engines and fixed-pitch airscrews.

D.H.86 data.—Span, 64ft. 6in.; length, 46ft. 1in.; all-up weight, 10,250 lb.; weight empty, 6,250 lb.; payload, 3,215 lb.; wing area, 641 sq. ft.; wing loading, 16 lb./sq. ft.; power loading, 13.86 lb./h.p.; maximum speed, 166 m.p.h.; cruising speed (on 65 per cent. power), 142 m.p.h., and cruising range, 750 miles.

Makers: The De Havilland Aircraft Co., Ltd., Hatfield Aerodrome, Herts (Hatfield 2345).

GENERAL AIRCRAFT

DESIGNED to meet the requirements of the charter operator, private owner or those air line companies which are experimenting with the traffic potentialities of new routes, the Monospar S.T.25 has been very little changed during the past few years. The type is now known as the Universal, and the cabin is specially designed for conversion for different purposes.

The machine can be used either as a normal passenger-carrying craft for feeder work or for ambulance purposes and freight carrying, the necessary modifications being made in a comparatively short space of time. The type is probably best known in its ambulance form, and the special all-white demonstrator has been seen about in this country and in Europe a great deal. With the object of facilitating this work or, in the case of the freighter, for loading and unloading bulky objects, the cabin has special large-aperture door on the starboard side, in addition to the standard folding roof and the door on the port side.

The Universal is an all-metal fabric-covered low-wing monoplane with twin fins and rudders. It is powered with two Pobjoy Niagara III engines and carries, in passenger layout, four or, in special cases, five people. As in earlier years the Universal and its forerunners are notable specially for the Monospar type of wing construction in which pyramid bracing is used to take drag loads. The wings are arranged to fold outboard of the two engines. The fuselage is built in two sections, that in the front consisting of a shallow tray of steel tube, while that at the rear is built around a duralumin beam on Monospar principles. Dual rudders are arranged with a swing-over control column and the equipment in the standard machine includes navigation lights, a landing light, and the usual blind-flying instruments.

MONOSPAR UNIVERSAL DATA.—Span, 40ft. 2in.; length, 25ft. 4in.; all-up weight, 2,875 lb.; weight empty, 1,818 lb.; wing-loading, 13.21 lb./sq. ft.; power-loading, 17.08 lb./h.p.; maximum speed, 131 m.p.h.; cruising speed on 70 per cent. power, 115 m.p.h.; stalling speed, 60 m.p.h.; rate of climb, 710 ft./min.; service ceiling, 13,000ft.; range at cruising speed, 420 miles; and price, £2,250.

Makers: General Aircraft, Ltd., London Air Park, Feltham, Middlesex (Feltham 2604).

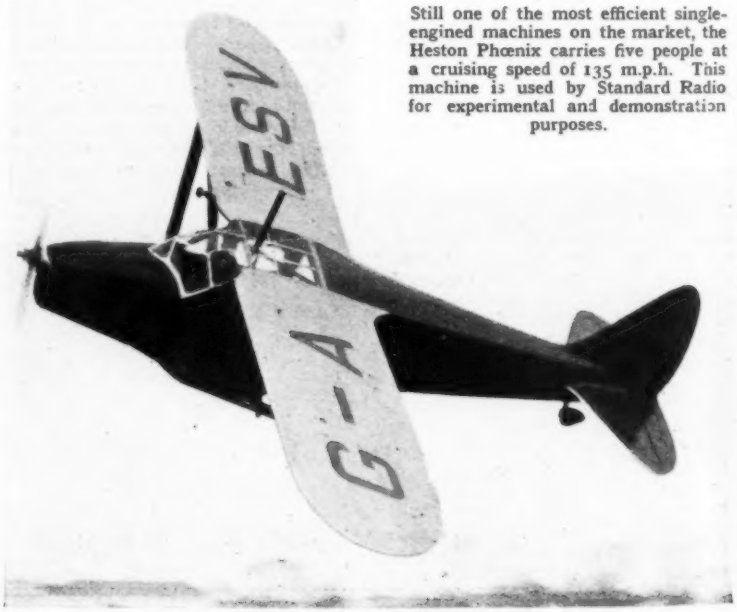
The Monospar ST.25, which is now known as the Universal, can be rapidly converted for passenger carrying, freighter or ambulance use. It is shown here in its ambulance guise.

HESTON

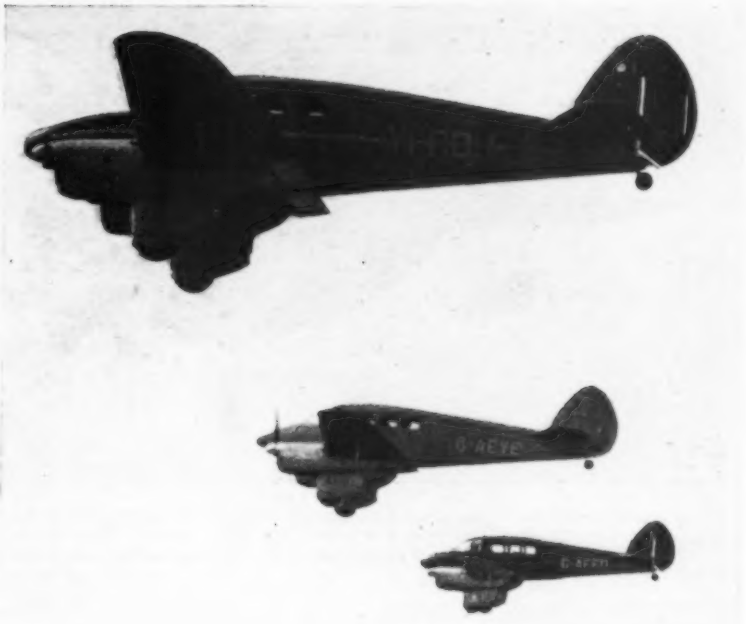
ALREADY, in its original fixed-pitch-airscrew form, the Heston Phœnix had a remarkable performance for its power, but with the introduction of a version with a Series II Gipsy Six and v.p. airscrew the cruising speed at altitude was increased and the take-off run was shortened. This cruising speed is rather better than 135 m.p.h., which, for a machine carrying five persons in a roomy cabin on a little more than 200 h.p., must be considered as excellent, even though the design is now several years old.

The machine was laid out in the first place for economical feeder line and charter work, and considerable attention has been paid to the provision both of physical and aural comfort. It would probably be fair to say that the Phœnix is the quietest single-engined machine on the market in any country. With such a type in existence it is, perhaps, curious that several private owners have purchased more expensive, but no more roomy, machines in the same class from America.

The airframe is entirely of wood, with a strut-braced high wing and a semi-monocoque structure for the fuselage aft of the cabin. It has a retractable undercarriage, and in order to accommodate this in a high-wing machine the struts are arranged to be attached at their base to a form of



Still one of the most efficient single-engined machines on the market, the Heston Phœnix carries five people at a cruising speed of 135 m.p.h. This machine is used by Standard Radio for experimental and demonstration purposes.



One of the more recent additions to the range of medium-size transport aeroplanes is the Percival Q6, which, with Series II Gipsy Sixes, cruises at 172 m.p.h.

stub-wing, which also provides a certain amount of lift as well as some considerable measure of protection in the unlikely event of a forced landing. With the later design of windscreen, and with the high-wing layout, the view for the pilot—and, in fact, for all the occupants—is exceptionally good.

The equipment of the Phœnix is as complete as it should be. An electric self-starter, a windmill-driven generator, with lighting equipment and the necessary battery, are considered as standard extras, and their incorporation reduces the payload given in the table below by a small figure (110 lb.) which makes little difference to the very considerable weight which may be carried.

SERIES II ENGINED PHOENIX data:—Span, 40ft. 4in.; length, 30ft. 2in.; all-up weight, 3,300 lb.; weight empty, 2,150 lb.; maximum speed, 150 m.p.h.; cruising speed, 135-137 m.p.h.; landing speed, 55 m.p.h.; initial rate of climb, 800ft./min.; cruising range, 725 miles; and price, £2,050 (with Series II engine) or £1,700 (with Series I engine).

Makers: The Heston Aircraft Co., Ltd., Heston Airport, Middlesex. (Hayes 730-1.)

PERCIVAL

ALTHOUGH the Percival Q.6. has only been in existence for a comparatively short time, quite a number of them are in use, and, more recently, two have been sold for internal airline work in Lithuania. There are actually two versions of the Q type; one, the Q.6., is fitted with Series II Gipsy Six engines and v.p. or constant-speed airscrews, and the other, the Q.4., is fitted with two Gipsy Majors. The latter is not perhaps so well known, and the more important figures for loading and speed are as follows: All-up weight, 4,750 lb.; weight empty, 3,000 lb.; maximum speed, 173 m.p.h.; cruising speed (with fixed undercarriage), 155 m.p.h.; and standard range 700 miles.

With two Gipsy Sixes the Q.6. may be described as a six-seven-seater designed for the fast yet economical work either on airlines or for special charter and general military or civil duties, though one or two private owners are already using them. As in the case of the smaller Percival types the structure is of wood with a new type of torsionally rigid spar and ply-covering for the three-section cantilever wing, and plywood box construction with fabric covering (carried on stringers and formers) for the fuselage. The tail unit is fully cantilever. In standard form the undercarriage is fixed and is faired in deep trousers, but the retractable type of undercarriage can be fitted if the purchaser so desires.

In the ordinary way the cabin is arranged without a bulkhead between the pilots' section and that used by the passengers. Dual control is provided, with the throttle, mixture, airscrew, flap, brake, and trimming controls centrally disposed between the two pilots. The standard equipment includes Sperry free gyro instruments, landing and navigation lights, and engine starters. Heating and ventilation are controllable.

PERCIVAL Q.6. data: Span, 46ft. 8in.; length, 32ft. 3in.; all-up weight, 5,500 lb.; weight empty, 3,500 lb.; wing-loading, 19.8 lb./sq. ft.; power-loading, 13.4 lb./h.p.; maximum speed, 195 m.p.h.; cruising speed at 7,000ft. (fixed undercarriage), 172 m.p.h.; landing speed (with flaps), 58 m.p.h.; service ceiling, 21,000ft.; ceiling on one engine, 6,500ft.; rate of climb, 150ft./min.; and cruising range with standard tankage, 700 miles.

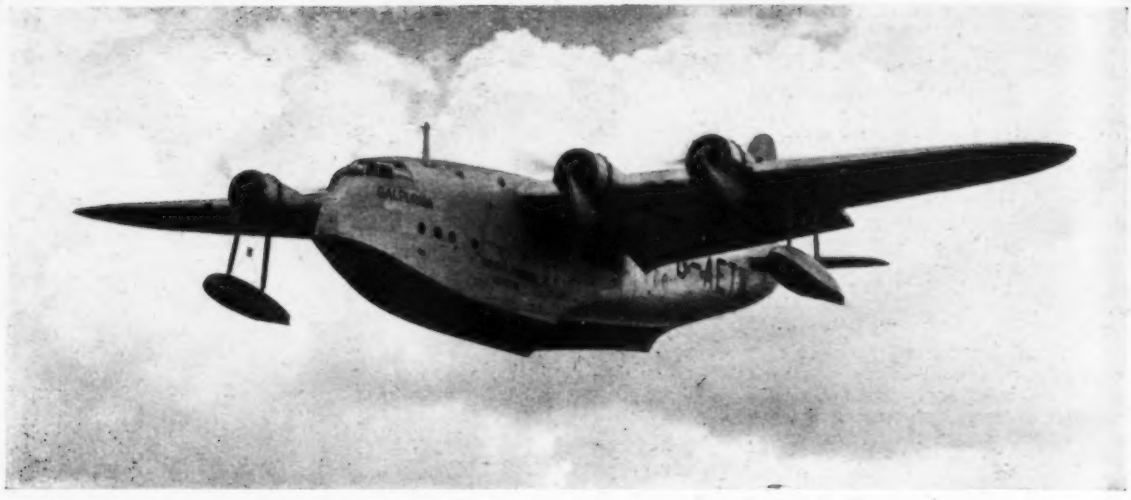
Makers: Percival Aircraft, Ltd., The Airport, Luton, Beds (Luton 2960), and 20, Grosvenor Place, London, S.W.1 (Sloane 3274).

POBJOY

ORIGINALLY the makers of a well-known aero engine, the Pobjoy Company has more recently started to manufacture machines, and, incidentally, certain parts of military machines. Their start in this direction was actually made with the Short Scion, for which the manufacture was taken over from Short Brothers.

This machine is an all-metal high-wing twin-engined monoplane designed specially for feeder-line and charter work. The normal accommodation is for five passengers, but an additional seat can be fitted. The engines are, of course, Pobjoy Niagara III radials. Economy of operation was the designer's primary interest, and it is claimed that the Scion can be operated at a profit of 4d. per passenger-mile when flown at

The Pobjoy-Short Scion, an economical feeder-line or charter type carrying five passengers.



Too well known even to require naming, an example of the Short Empire boat is shown here with the Gouge flaps partly depressed. The first of the eight new high-payload versions of the same machine should be coming out of the Rochester works very shortly. A modified version of the Empire boat forms the lower component of the Short-Mayo Composite Aircraft.

an average load of 60 per cent. of the full available capacity.

Although originally produced and perhaps better known in landplane form, the machine can also be fitted with twin floats of Short design, and in seaplane form the payload is only reduced by a relatively small amount.

POBJOY-SHORT SCION data:—Span, 42ft.; length, 31ft. 6in.; all-up weight, 3,200 lb.; weight empty, 1,920 lb.; maximum speed, 130 m.p.h.; cruising speed, 115 m.p.h.; and cruising range, 400 miles.

Makers:—Pobjoy Airmotor and Aircraft, Ltd., Rochester, Kent (Chatham 2277).

SHORT

EIGHT new flying boats, modified versions of the four-engined Empire type which has contributed so largely to the initial success of the all-up Empire air mail scheme, are now coming through the Short works at Rochester. The first, *Champion*, is practically complete, and *Cabot*, which is scheduled for an Atlantic flight this autumn, is following close behind. The remainder of the boats should emerge at fortnightly intervals.

The new boats have been strengthened to carry increased loads in comparison with the standard Empire type, which has an all-up weight as a passenger carrier of 40,500 lb. *Champion* has the same power plant as the earlier boats—four Bristol Pegasus Xc radials—but will operate at a weight of 45,000 lb. *Cabot* and the rest are fitted with four Perseus XIIC sleeve-valve radials, and will fly at a weight of 53,000 lb. All these latter craft are designed for air refuelling.

It was lately announced that orders have been placed with the Short Company for several new landplanes of more than 31 tons gross weight. One machine will be built with a pressure cabin, and should cruise at about 250 m.p.h. for 3,000 miles.

New flying boats weighing about three-quarters as much again as the standard Empire type are also under construction. These machines will have four of the new Bristol Hercules two-row sleeve-valve engines.

The standard Empire boat, as now in operation, has a wing embodying a central girder built up of two spars of hiduminium extruded sections braced by tubes and connected by former ribs. The flaps are of the Gouge "dragless" type. The two-step hull has closely spaced rings and continuous stringers. Counter-sunk riveting is used throughout.

For daylight operation the boat carries a crew of five, twenty-four passengers, baggage, and a ton and a half of mail. Sixteen passengers can be accommodated by night, although the sleeper version is not in regular use.

SHORT EMPIRE FLYING BOAT data are:—Span, 114ft.; length, 88ft.; wing area, 1,500 sq. ft.; weight, empty, 24,000 lb.; all-up weight 40,500 lb.; top speed, 200 m.p.h.; maximum cruising speed, 164 m.p.h.; minimum flying speed, 73 m.p.h.; absolute ceiling, 20,000ft.; take-off with full load, 21 sec.; and range, 810 miles.

Makers:—Short Bros. (Rochester and Bedford), Ltd., Rochester, Kent.

MAYO

FORMED in 1935 to develop the composite aircraft invented by Major R. H. Mayo, the Mayo Composite Aircraft Co. has co-operated very closely with the Short Company, which concern constructed the upper and lower components—*Mercury* and *Maia*—of the Short-Mayo composite aircraft owned by Imperial Airways.

Mercury has lately been in the news through her 6,045-mile flight from Dundee to the mouth of the Orange River, South Africa, breaking, by more than 800 miles, the world's seaplane long-distance record held by Germany. The flight lasted just over 42 hours and was made at a considerably higher average speed (in spite of adverse conditions) than any comparable record-breaking journey.

When launched, the wing of the upper component was loaded to 45 lb./sq. ft., and her power-weight ratio was no less than 20 lb./h.p.—a combination of loadings never previously obtained. Evidently there is ample margin for yet heavier loadings.

Briefly, the composite aircraft as at present in being comprises a comparatively small four-engined floatplane carried on the back of a modified Short Empire flying boat. When the combination has climbed to a suitable height the upper component is released in such a manner that there is no risk of fouling the supporting superstructure. A predetermined value of excess lift is indicated by instruments, and the machines remain locked until three conditions are met. Thus the upper component can fly at a much greater all-up weight than would be possible with a take-off under its own power.

Mercury, the upper component, has a spar with booms of extruded hiduminium into which is built the main petrol tank. The engines are four Napier-Halford Rapier VIs (24 cylinders), which have shown marked economy on long-distance flights.

The lower component has wings of larger area than those of the standard Empire boat and flared-out chines making for stability on the water.

The maximum cruising speed of *Mercury* is in the neighbourhood of 180 m.p.h. Further data are: span, 73ft.; length, 51ft.; and wing area, 611ft.

The Mayo Composite Aircraft Co., Ltd., 55-58, Pall Mall, London, S.W.1 (Whitehall 1447).

HERE and THERE

Aeronautical News of the Week

"Aircraft Production"—the New Monthly

THE first issue of *Aircraft Production*, dated November, is now on sale. This is the new monthly publication by Iliffe and Sons, Ltd.—the only one in the world devoted solely to the technical aspects of aircraft and aero engine manufacture.

Features of this first issue include a description of the Austin Shadow Factory, in which are produced Fairey Battle bombers; an article stressing the importance of co-operation between production and inspection, by Lt.-Col. H. W. S. Outram, C.B.E., the new Director of Production (Aircraft); a description of the manufacture of aircraft radiators; an article examining the spot-welding methods of a pioneer German firm; and descriptions of special French and American plant, as well as regular features which include a review of selected British and foreign machine tools, small tools and shop equipment.

Aircraft Production appears on the fourth Wednesday in each month, price 1s.; annual postal subscription rate 16s.; Canada 13s. 6d.

Reductions to Paris

AS before, British Airways are offering special fares to members of the aircraft trade and allied industries who are travelling over to Paris for the Exhibition next month. These fares involve the reduction of ten per cent. of both single and period returns on the service, and the reduction will be effective on tickets purchased between November 18 and December 11 (outward journey) and between November 25 and December 18 (return journey).

Production Expert for Loughborough Research

DR. GEORG SCHLESINGER, who has recently been doing consulting engineering work in this country, is shortly to take charge of the new research centre at Loughborough College, which is being organised by the Institution of Production Engineers and the Institution of Mechanical Engineers. Dr. Schlesinger is probably the leading authority on production methods, jigs and tools. Lord Nuffield, who has provided £25,000 towards the cost of the research scheme, feels sure that he will pass on much useful information to engineers in this country.

Dr. Schlesinger, who was at Charlottenburg Laboratory, has organised and run some of the largest plants in Europe. He is a professor of Brussels University.

Radio Agreement

BETTER working arrangements for air radio operators will result from an agreement which has recently been made between Imperial Airways and the Radio Operators' Union. The agreement provides for an initial wage of £4 10s. a week in the first year, rising to £6 5s. in the eighth year. Those operators flying on the Empire services will receive 8s. a day while away from their bases, and those on European services will receive extra pay at the rate of 1d. for ten flying miles. In the salary scales, two years' seniority is offered to operators of five years' previous experience.

The agreement will be in action for three years—a period which will give both Imperial Airways and the Union a chance of discovering how things work. Provision is also made in the agreement for an annual leave of three weeks.

A Lancashire Aerodrome Problem

THE fact that the Air Ministry is developing, for factory and Reserve training purposes, an aerodrome site at Grange Farm, near Preston, has caused some doubt in the minds of the Corporations of Preston and Blackburn, the members of which had already intended to develop a joint municipal aerodrome to serve both towns.

Last week Sir Kingsley Wood received a deputation from the Corporations concerned and explained the reason for the new Grange Farm aerodrome, while promising that if the municipal site at Samlesbury is developed the Air Ministry would be prepared to place a second Volunteer Reserve centre there. Sir Kingsley Wood also explained that it was possible that the Air Ministry would be able to make use of this site for other purposes, and a local investigation will be carried out by the Air Ministry in conjunction with the municipal authorities.

International Alloys, Ltd.

IT is announced that Col. W. C. Devereux, F.R.Ae.S., M.I.Ae.E., managing director of High Duty Alloys, Ltd., has joined the board of International Alloys, Ltd., of Buckingham Avenue, Trading Estate, Slough, Bucks.

International Alloys are increasing their plant and undergoing reconstruction in connection with new developments regarding light alloys in general; they will not confine their activities, as in the past, to the production of refined aluminium alloy ingots.

Indians for India

IN recent years the Government of India has made considerable efforts to assist Indians in aviation training. Scholarships for "B," wireless operator, ground engineer and instructor licensees, as well as for research students, are being awarded, and this assistance is not confined to the Central Government. A number of scholarships have also been granted by provincial authorities, Indian states and some private bodies.

Needless to say, in actual flying training the subsidised flying clubs have rendered valuable service. During 1937, 64 pilots qualified for their "A" licences, 8 for their limited commercial licences, and 12 for "B" licences. The 41 ground engineers now in employment were also trained at these clubs, and altogether they are able to claim that 109 of their members have found employment after experience with them. One of the better-known Indian engineers, Mr. P. Nazir, who carries out researches in aerodynamics with Government aid, has already produced results in the form of modified slot gear for the improvement of lateral control.

Forestalling Possible Disaster

SINCE a supply of helium is at present denied to the Zeppelin Company, experiments are being carried out to devise methods by which static electricity inside and outside an airship may be equalised.

The basis of the tests, about which there seems to be some secrecy, is an instrument which records the nature and intensity of the static charge in an airship in relation to that of the atmosphere surrounding the envelope. If the instrument shows that the difference is considerable, the commander would presumably "earth" his ship before valving hydrogen for landing. It will be remembered that the disaster to the *Hindenburg* at Lakehurst was caused by unintentional earthing coupled with unusual complications of atmospheric conditions.

Several earthing experiments on a small scale have already been made, and the new airship will provide opportunities for full-scale tests.

In Eighteen Languages

A SECOND edition of *Bon Voyage*, the Shell-Mex motorist's touring phrase-book, covering 18 European languages, has been issued and is obtainable at 3d. from Shell-Mex House, London, W.C.2. A "Gourmet's map" of Europe is an intriguing addition.

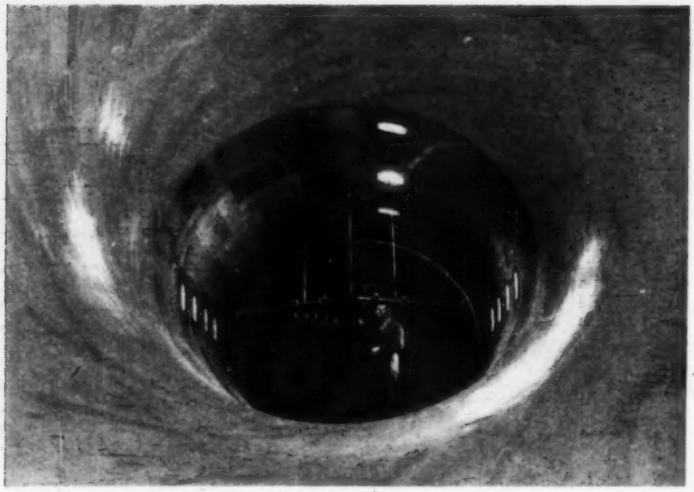
NEXT WEEK:

BRITISH AIRCRAFT INDUSTRY NUMBER (II): ENGINES & EQUIPMENT

A COMPANION to this week's special number, next week's special issue will contain a detailed and fully illustrated review of current British aero engines. There will also be *FLIGHT'S* annual guide to the products of firms of, and associated with, British Aircraft Industry. Dealing this year with well over 400 firms, this guide will be indexed for easy reference both under the titles of the firms and under some 200 classes of product.

Retained for reference in the office, works or home, these two issues of *FLIGHT* should prove of great value for months to come.

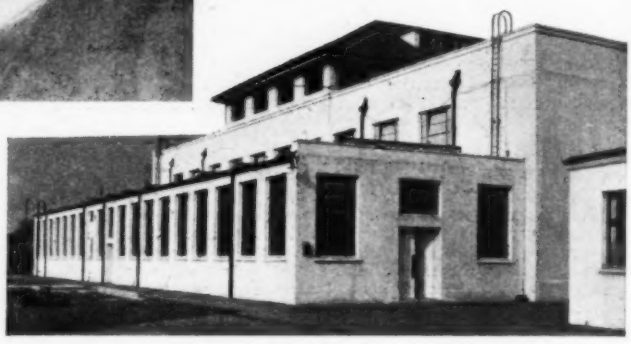
THURSDAY FLIGHT NOV. 3



"Flight" photographs.

A FACTORY with its own FARNBOROUGH

New Fairey Research Department Opened by the Air Minister



The new research department (seen on the right) at the Fairey works at Hayes was opened by the Air Minister last Monday. The wind tunnel (above) is housed in a building 121ft. 6in. long, 63ft. wide, and 29ft. high. The working section of the tunnel measures 12ft. across and is 10ft. high. The model of a four-engined commercial aeroplane is seen in position in the tunnel.

THERE are several very good reasons why every aircraft firm of importance should have its own research establishment. Even in the early days aircraft designers depended a good deal upon the results of wind tunnel tests. The Wright brothers made extensive use of model tests in their small wind tunnel, and ever since the designer has based his work very largely on data obtained in this way.

For many years the aircraft industry had to be content with having their models tested in Government establishments such as the N.P.L. and the R.A.E. Nowadays, however, the volume of work to be undertaken has grown at such a rate that delays in getting test results are inevitable. In the absence of a wind tunnel a firm will often do without model tests because of the delay involved, and may thereby lay up future trouble for itself. This is particularly the case when departing radically from well-tried layouts.

Although one can easily point to famous aircraft firms which have never possessed a wind tunnel, and have yet managed to produce really first-class aeroplanes, no one could guarantee that, had a wind tunnel been available, even better results would not have been obtained.

Considerations such as these led the Fairey Aviation Co., Ltd., to embark upon the establishment of a new research department, and last Monday this was officially opened by the Secretary of State for Air, Sir Kingsley Wood.

Congratulating the Fairey Company on their enterprise, Sir Kingsley Wood said it was impossible to exaggerate the importance of research, and this was particularly the case with reference to the air and air defence.

One of the greatest benefits that could come to mankind would be the discovery of some effective means to defeat the bomber. He did not despair that this would come, and many were engaged upon that work.

Other and important kinds of aeronautical research were also being actively pursued, and he was glad to say that in this the aircraft industry itself was playing an increasingly important part. Close liaison was maintained between the industry, the Air Ministry, the Aeronautical Research Committee and the Experimental Establishments. Certain universities were also contributing effective help. There was free interchange of ideas and suggestions. Arrangements were in hand for making fuller use of the increasing facilities for research at contractors' works, and steps were also being taken to subsidise further research in connection with materials, as was the case in relation to engine research work.

The new research department includes three sections, which deal with aerodynamics, structures and metallurgy respectively. The wind tunnel is a very large one and is of the closed-circuit type, with a working section measuring 12ft. across and 10ft. in height. An electric motor of 350 h.p. drives a 14ft. diameter four-bladed metal fan, and speeds of approximately 145 m.p.h. can be maintained. Power is taken from the mains at 6,600 volts, stepped down to 420 volts for the a.c. motor of 410 h.p. which drives two direct-current generators which, in turn, supply the windings of the output motor. It may be significant that on the day of the opening a model of a four-engined commercial aeroplane was being tested in the tunnel.

The mechanical test laboratory is extremely well equipped, as is also the metallurgical and chemical laboratory. Space does not permit of describing this equipment in detail, but it is of interest to record that hydraulically controlled fully feathering airscrews were seen undergoing mechanical tests in the laboratory on the day of the opening. The new Fairey v.p. airscrew hub has a very simple and ingenious operating mechanism and seems destined to be used extensively in the near future.

PRODUCTION ENGINEERS DISCUSS REARMAMENT

AT the dinner of the Institution of Production Engineers, held at the Dorchester Hotel, London, on October 21, the main theme of all speakers was the necessity of air expansion and intensified production efforts.

Sir Kingsley Wood, Dr. Flemming, Lord Nuffield, Lord Austin and Lord Sempill all stressed the importance of the part which the production engineers were playing and would play in the future, especially in furthering aircraft production. An important factor in this effort was the free exchange of production ideas so that newcomers to the industry could become fully *au fait* with aircraft methods, and the aircraft industry, in return, be shown sound and successful commercial practice. Now that orders were at hand—orders worth tooling—the job could be got on with so that Britain would have all that could be required in the air. With proper arms, peace was assured.

Lord Nuffield, in particular, maintained that there was ample room at the top for young and effective engineers, who, at the moment, were hiding their light under a bushel. In common with other industrialists, he wanted to know of their presence. Lord Nuffield and Lord Sempill both mentioned the National Certificates in Production Engineering which they hoped the Board of Education would soon find themselves in a position to grant.

BRITISH MILITARY AIRCRAFT

Peerless Fighters and Bombers: Highly Developed Trainers: Some New Data

Illustrated largely with "Flight" photographs

A COMMON fault among politicians and others who set out to compare Britain's military aircraft with those of other nations is to discuss prototypes and standard-production type aircraft in the same breath.

The majority of the machines dealt with in this review happen to be Service equipment in the R.A.F.; certain new prototypes, though familiar to residents around some of our aerodromes, are still officially secret.

Because this survey makes no reference to really modern examples of multi-seater fighters, four-engined bombers, deck-landing aircraft of certain types and reconnaissance machines, it is not to be doubted that developments in these categories are under way.

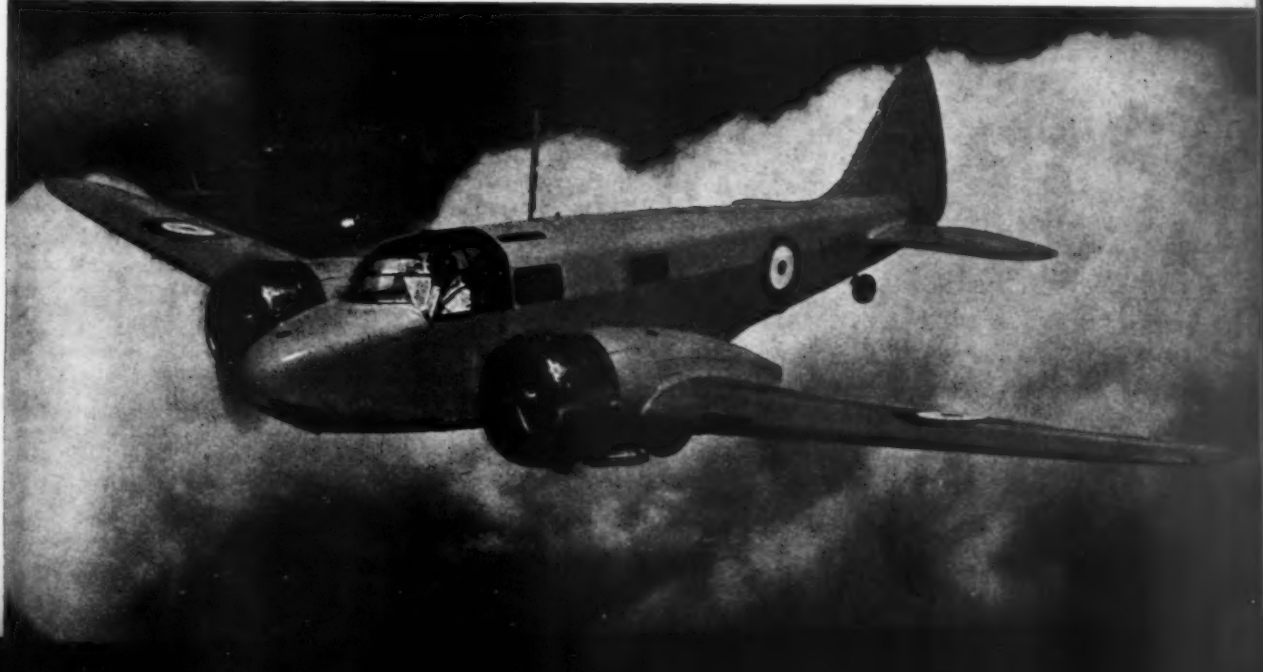
Among the types now in large-scale production and in squadron use in the R.A.F. are the fastest and most heavily armed single-seaters; the fastest and most carefully defended bombers; the most capacious and practical long-range flying-boats; and the most highly developed trainers.

Data on certain of these machines are still confidential, but most of the information which has been released is given in the following pages which deal, within official limits, with all current types of British military aircraft.

The Supermarine Spitfire (Rolls-Royce Merlin)—the fastest standard military aircraft in the world.

AIRSPEED

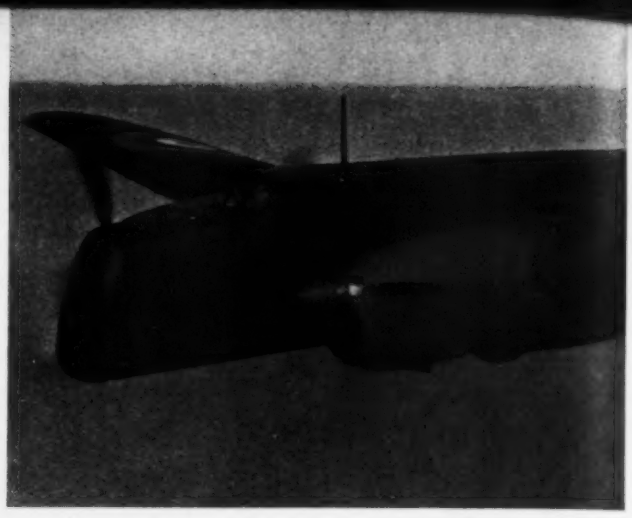
The name of Airspeed has so far been associated with three military or semi-military aircraft. With a view to providing an economical transport monoplane which could be used as a bomber or as a reconnaissance machine



Roominess is not sacrificed to performance in the Airspeed Oxford advanced trainer, now being delivered to R.A.F. units.

the company built the Convertible Envoy, which may be transformed from a passenger carrier to a useful military type quickly and easily—actually, the complete conversion can be carried out by four men in under eight hours.

Reproducing many of the characteristics of the



Two versions of the Armstrong Whitworth Whitley bomber. The model below has Siddeley Tiger radials, but that on the right—the Whitley IV—is fitted with Rolls-Royce Merlins.

Envoy, but in reality an entirely new type, the Airspeed Oxford advanced trainer now in series production at three factories in this country is the type on which the company is now concentrating

A unique wireless-controlled target aircraft—the Queen Wasp—appeared last year and has been subjected to intensive trials with wheel and float undercarriage. The machine is a wooden biplane with tapered wings and is powered with a Siddeley Cheetah IX engine.

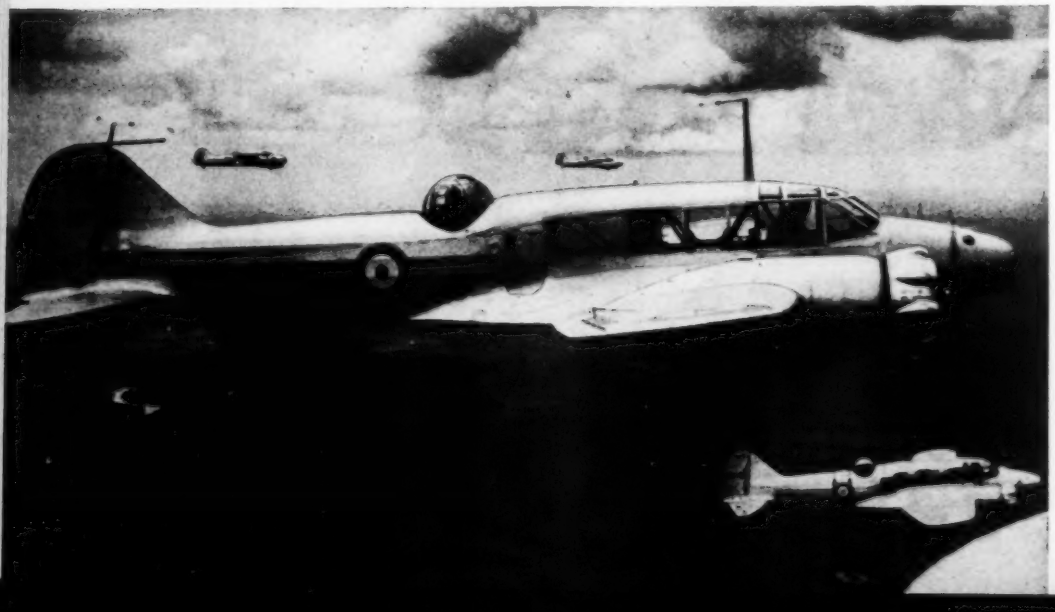
The Oxford twin-engined trainer is a low-wing cantilever cabin monoplane with two medium-supercharged Siddeley Cheetah X radials provided with long-chord cowlings.

To meet Air Ministry requirements the wing is made so that it may be readily transported by road. The structure is in three parts, the outer sections being tapered in plan and thickness. Stressed-skin plywood covering, with wooden spars, makes for great torsional rigidity.

From aileron to aileron there are split trailing edge flaps operated hydraulically by pressure from an engine-driven pump or, in emergency, from a hand pump.

Semi-monocoque construction is employed for the fuselage, which is assembled in two sections. The extreme nose is of aluminium panelling and has a large Perspex window for the bomb-aimer.

The retractable undercarriage is operated hydraulically by an engine-driven pump and is fitted with Avery-type wheels.



An economical general purpose or reconnaissance machine, the Avro Anson is standard equipment in a number of countries. The machines shown belong to the Royal Australian Air Force.

The Avro 626 trainer is an economical and versatile type and has a number of applications apart from instruction.

Although the first Oxfords to be delivered have wooden airscrews the Cheetah Xs are designed to take the De Havilland-size 2,000 variable-pitch type or even constant-speed versions.

Normally the crew of the Oxford would never exceed three, but positions are provided for the following exercises: Twin-engined training, including blind-flying instruction; navigational, including night flying, wireless telegraphy and direction finding; bombing, including high-altitude flying with oxygen supply; aerial gunnery; and aerial photography (vertical).

Data are: Span, 53ft. 4in.; length, 34ft. 6in.; weight empty, 5,322 lb.; gross weight, 7,500 lb.; top speed, 192 m.p.h. at 8,000ft.; cruising speed, 166 m.p.h. at 5,000ft.; fuel consumption at 10,000ft. (62½ per cent. power), 13.4 gal./hr./engine; rate of climb at sea level, 1,340 ft./min.; take-off run (5 m.p.h. wind), 245yd.; service ceiling, 23,500ft.

Airspeed (1934), Ltd., The Airport, Portsmouth.

ARMSTRONG WHITWORTH

The Whitley twin-engined bomber has been supplied to, or ordered for, the R.A.F. in five versions, differing in the type of engine fitted and in the nature of the armament installations. It will suffice here if we refer only to the Whitley's III, IV, V, the former being the latest of the Whitleys to be fitted with Siddeley Tiger engines, the Mark IV having Rolls-Royce Merlin IVs and the Mark V Merlin Xs. The following structural description applies to all Whitley models.

Built in three sections round a box spar with vertical corrugated walls and spanwise corrugated top and bottom, the wing is slightly tapered and has a marked dihedral angle. Leading and trailing edges are bolted to this main spar, the trailing edge being fabric-covered. Hydraulically operated trailing edge flaps extend from aileron to fuselage on each side. The ailerons are of the Frise type.

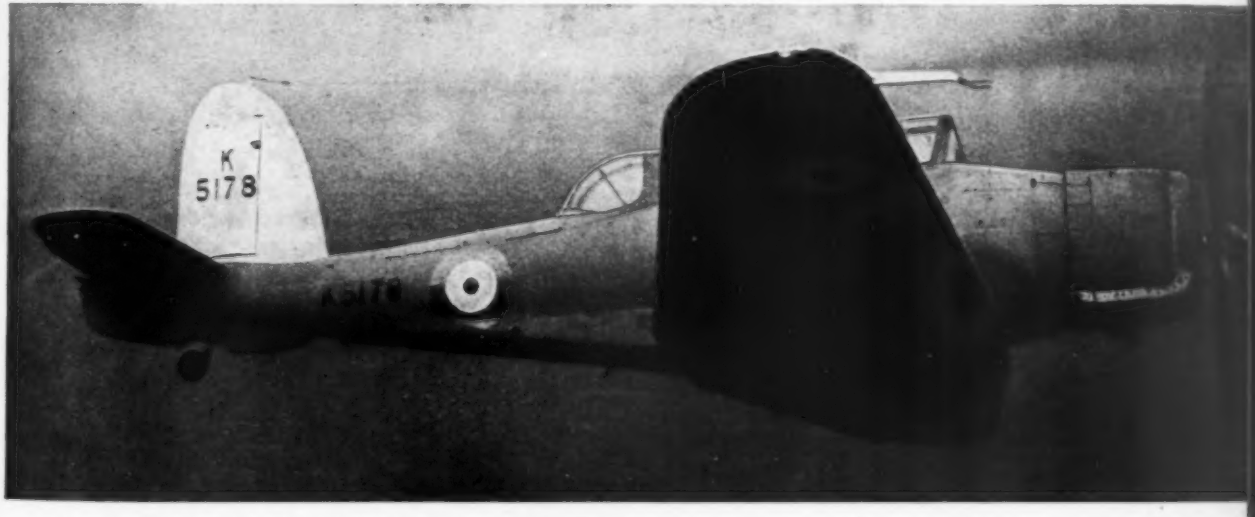
The fuselage tapers comparatively little in depth and is built in three sections. It is a metal monocoque structure with smooth sheeting riveted to the stringers, which are supported by hoops of open section.

The tail has twin fins and rudders, the fins, elevator and rudders being covered with fabric.

The wheels of the undercarriage retract forward into the engine nacelles. There are three fuel tanks, two in the wings and one in the fuselage. When the Tiger engines are fitted they are carried on welded steel-tube mountings and are fitted with D.H. variable-pitch airscrews and faired by the standard type of Armstrong Siddeley long-chord cowling.

A crew of five is normally accommodated, and there are gun positions in the nose, amidships and in the tail. In the later types of Whitley nose and tail turrets are power operated, whereas the earlier models have the manually operated Armstrong Whitworth type. The bombs are carried in the centre section and in the fuselage, below the floor, the doors to the bomb cells being kept closed during flight by spring loading.

The following data apply to the Whitley III (A.W. 38, Specification 20/36) with two Tiger VIII two-speed-supercharged 14-cylinder radials. These engines have a combined output of 1,836 h.p. for take-off; 1,580 h.p. for initial climb; deliver 1,610 h.p. in level flight at 15,000ft.; and 1,000 h.p. for normal cruising at the same height, using 65 gal. of fuel per hour. Dimensions are: Span, 84ft.; length, 69ft. 3in.; height, 15ft.; wing area, 1,232 sq. ft.; weight empty, 15,750 lb.; and the gross



Bristol Mercury sleeve-valve engines will be fitted to later models of the Blackburn Skua fleet-fighter dive-bomber (above). The Blackburn Shark (below) is a sturdy, well-tried biplane used by the Fleet Air Arm.

On the left is the prototype of the Bristol Bombay bomber transport with Bristol Pegasus engines. This model is now in production in the Short and Harland works at Belfast. The Bristol Blenheim (below) is very widely used by the R.A.F. as a bomber.

weight 24,000 lb., giving a wing loading of 19.45 lb./sq. ft. The top speed at sea level is 185 m.p.h.; at 15,000ft. 215 m.p.h.; and the machine will cruise at 177 m.p.h. on 66 per cent. power at 15,000ft. The stalling speed is given as 59 m.p.h., the initial climb as 800 ft./min. and the service ceiling 22,000ft. At cruising speed the range is 1,315 miles.

Sir W. G. Armstrong Whitworth Aircraft, Ltd., Whitley, Coventry.

AVRO

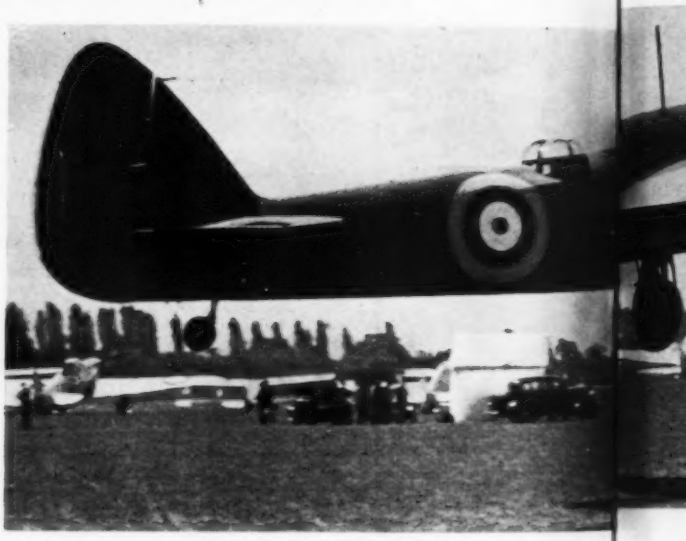
The most recent Avro type which it is possible to discuss is the Anson twin-engine monoplane employed by the R.A.F. on general reconnaissance and advanced training duties and supplied to various foreign governments as a general-purpose machine.

In layout the Anson is a low-wing monoplane with retractable undercarriage. The fuselage is a welded tubular-steel structure with fabric covering over wooden stringers. The wing is of cantilever all-wood design embodying two box-spars of spruce and plywood construction, with ribs of the same materials and with plywood covering. Frise balanced ailerons are fitted and the current type is provided with split trailing edge flaps.

The standard power plant is two Siddeley Cheetah IX radials, each giving 310 h.p. at 6,000ft. and driving fixed pitch Fairey airscrews.

A crew of three is normally accommodated. The pilot's seat is in the nose on the port side; when dual controls are fitted a second seat is installed alongside. The pilot has control of a fixed Vickers gun, and there is an Armstrong Whitworth manually operated turret on top of the fuselage behind the wing. In the extreme nose is a bomb-aimer's position; the bomb-aimer is normally stationed behind the pilot where he does the navigating. Internal stowage is provided for two 100-lb. and up to eight 20-lb. bombs in the centre section of the wing. The wireless operator/gunner's seat is behind that of the navigator.

The undercarriage retracts mechanically into the engine nacelles, leaving a portion of the wheels exposed when raised.



As the Ansons supplied to the R.A.F. are largely used for over-sea reconnaissance, a collapsible dinghy, marine distress signals and similar equipment is accommodated. The wooden wing, of course, gives a good measure of flotation.

Data for the Anson are: Span, 56ft. 6in.; length, 42ft. 3in.; gross weight, 8,000 lb.; top speed, 188 m.p.h. at 7,000ft.; cruising speed, 160 m.p.h. at 6,000ft.; duration at cruising speed, 4.7 to 5 hr.; climb to 10,000ft., 12.1 min.; service ceiling, 21,400ft.

Two Avro biplane types popular in many parts of the world are the Tutor and the 626. The Tutor is a staggered biplane with Siddeley Lynx engine, and is intended primarily for training. The 626 is a development of the Tutor and was developed for instruction in general flying, blind and night flying, gunnery, bombing, the use of wireless, photography, navigation and picking up messages. The engine of the 626 is normally the Siddeley Cheetah. Like the Tutor, the 626 can be supplied with float undercarriage.

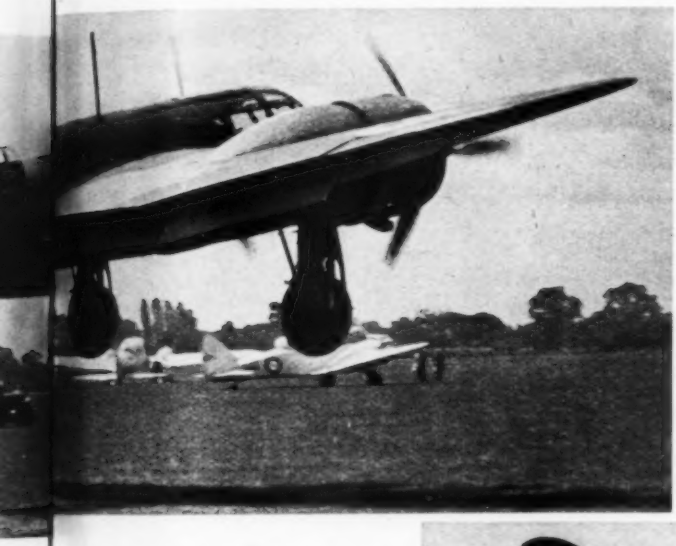
A. V. Roe and Co., Ltd., Newton Heath, Manchester.

The De Havilland Don communications machine with D.H. Gipsyking (or Gipsy Twelve) inverted vee air-cooled engine. Its top speed is 213 m.p.h.

BLACKBURN

To the Blackburn Company went the credit of designing the first monoplane to be adopted as standard equipment by the Fleet Air Arm. The machine is the Skua two-seater fleet fighter dive bomber—a low-wing all-metal monoplane with undercarriage legs which retract by swinging upward and outward into recesses in the wing. The prototype Skua and, for that matter, the first production machines, are fitted with the Bristol Mercury, but later models will receive the Bristol Perseus—as likely as not the fully supercharged Series X.

The wings—which now have a pronounced dihedral angle on their extreme outer sections, may readily be folded for stowing and it is said that the operation takes no longer than with the Shark biplane used in large numbers in the Fleet Air Arm.



Split trailing-edge flaps are fitted not only to steepen the glide and reduce the landing speed (considerations of some importance in operating from the deck of an aircraft carrier), but to retard the speed in a bombing dive.

In accordance with Blackburn custom the Skua has a watertight monocoque fuselage which affords sufficient buoyancy to float the machine for a long period even if the cockpits should become flooded.

A notable feature of the design is the tail unit in which the fin and rudder are set farther forward than usual. The span is 46ft. and the width folded only 13ft. 11in.

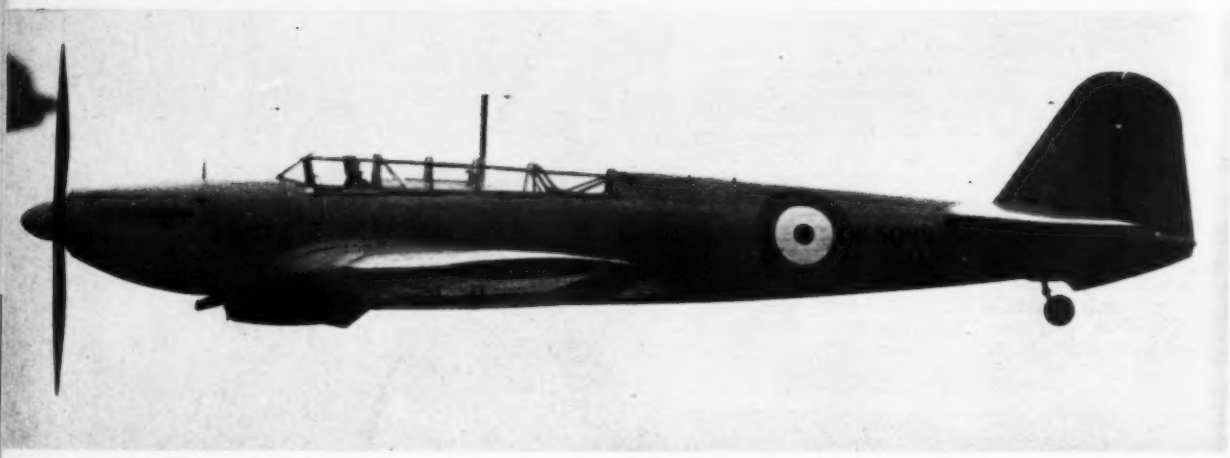
The Shark II biplane is intended for torpedo dropping, bombing, gunnery spotting, and reconnaissance, with either wheel or float undercarriage. Alternative power units are the Siddeley Tiger VI and the Bristol Pegasus X. Designed as a sesquiplane, the machine has folding wings which need no jury-struts, being braced by an N-strut system of steel tubes. As a torpedo bomber provision is made for carrying a torpedo or a load of bombs weighing about 1,500 lb., a crew of two and fuel for about 600 miles as a landplane or 500 miles as a seaplane. Used for fleet spotting or reconnaissance with no projectile load, provision is made for a crew of three and fuel for over 700 miles as a landplane or more than 600 miles as a seaplane. Two machine guns are included.

Arrangements can be made for catapulting, and slinging gear is incorporated in the top centre-section.

The following data apply to the Shark as fitted with

The ubiquitous De Havilland Tiger Moth biplane trainer, fitted with 130 h.p. Gipsy Major engine.

Extensively employed by the R.A.F., the Merlin-engined Fairey Battle bomber has a top speed of 257 m.p.h. Its manœuvrability is of a high order.



Designed as a high-speed light bomber, the Fairey P.4/34 is potentially a formidable fighter. On the right is the Seafox light reconnaissance seaplane with Napier Rapier engine.

Pegasus X engine and operating as a reconnaissance landplane: Gross weight, 6,946 lb.; wing loading, 13.9 lb./sq. ft.; landing speed, 61 m.p.h.; top speed 167 m.p.h.; rate of climb at sea-level, 1,520ft./min.; service ceiling, 20,700ft.; climb to 15,000ft., 16.5 min.

The Blackburn Aeroplane and Motor Co., Ltd., Brough, E. Yorks.

BOULTON PAUL

Although it is known that advanced types of military aircraft are in production at the Boulton Paul works, no data relating to these machines is available for publication. The last military type to be built by the company was the Overstrand twin-engined bomber, which was in many respects the forerunner of some of the faster types of bomber now going into service with the R.A.F. and which were until recently classed as medium bombers.

The Overstrand was fitted with a power-driven gun turret designed by the manufacturers, and developments of this turret are also believed to be in production.

Boulton Paul Aircraft, Ltd., Wolverhampton.

BRISTOL

Although the Bristol Company is world-famed for military aircraft of all types, the only machines to which it is permissible to refer at the moment are in the bombing category. More precisely, they are the Blenheim high speed twin-engined bomber and the Bombay bomber transport.

As supplied in large numbers to the R.A.F. by various factories, the Blenheim is known as the Mark I. It is used in the Service primarily as a bomber, though it can, in fact, be adapted for many different purposes—both naval and military—including fighting.

Light-alloy monocoque construction is used for the fuselage, which is sub-divided into three sections. These and the centre section of the wing are united by bolting only and the outer sections of the wing are attached in a similar manner.

The wing is also in three sections, the construction embodying two main spars with steel flanges and Alclad webs and with ribs of Alclad sheet, suitably lightened. Like the fuselage the wing has Alclad sheet covering.

The Fairey Swordfish (Pegasus) is doing excellent service as a torpedo spotter reconnaissance machine.

Flaps are fitted to the centre section and to the inboard portions of the wings so that there are four sections in all. They are constructed of Alclad and magnesium sheet and are operated hydraulically.

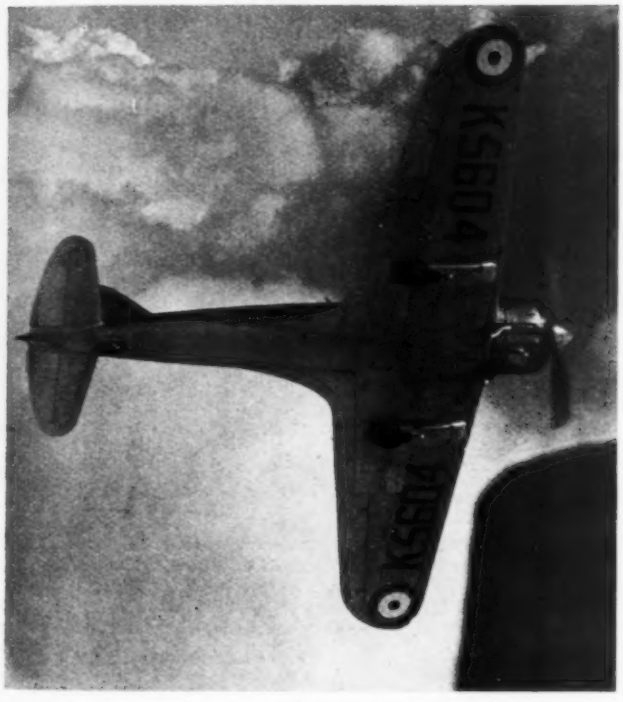
A single fin and rudder of very clean design are used, the elevator and rudder being fabric covered and aero dynamically and mass balanced.

Each half of the undercarriage retracts rearward into an engine nacelle, an hydraulically operated jack "break

ing" the radius rods at the knee joints. The up and down movements of the undercarriage are governed by selector and control valves on the right of the pilot's seat. Visual, audible and mechanical indicators are fitted. The pilot's seat is on the port side of the fuselage, from which position the forward and downward outlook is exceptionally good. Dual control can be fitted if required.

Apart from the pilot the crew consists of a bomb-aimer-navigator, who is normally seated alongside the pilot, and a wireless-operator-gunner in the rear fuselage.

A bomb cell under the centre section forms an integral part of the fuselage and provides for the stowage of various bomb loads. Racks for sighter bombs and flares are fitted beneath the centre section and practice bombs may be accommodated under the rear fuselage. Bombs are fused and released electrically. A Vickers or Browning gun operated by the pilot is installed in the port outer wing and an observer's type gun is carried in a special Bristol power-driven turret with retractable hood.



The Gloster Gladiator four-gun biplane fighter (above) is still in great demand. It does 250 m.p.h. On the left is a multi-gun fighter monoplane produced last year by the Gloster company.

The Blenheim I is fitted with two fully supercharged Mercury VIII engines giving a maximum output of 840 h.p. each at 14,000ft.

Data for the Blenheim are: Top speed, 285 m.p.h. at 15,000ft.; climb to 15,000ft., 11.5 min.; estimated service ceiling, 27,280ft.; estimated range at nominal speed of 200 m.p.h., 1,125 miles; take-off run, 296yd. The span is 56ft. 4in.; the length, 39ft. 9in.; the empty weight, 7,409 lb.; and the all-up weight, 12,030 lb.

The Bristol Bombay bomber-transport is now in production at the Short and Harland works. This model has Bristol Pegasus engines of the latest series driving Rotol constant-speed airscrews. It is arranged as a high-wing monoplane with a fixed undercarriage and can accommodate twenty-four fully armed troops. There are gun turrets in the nose and tail and auxiliary armament amidships. Dimensions are: Length 66ft. 9in.; span 96ft. and height 16ft.

The Bristol Aeroplane Co., Ltd., Filton House, Filton, Bristol.

DE HAVILLAND

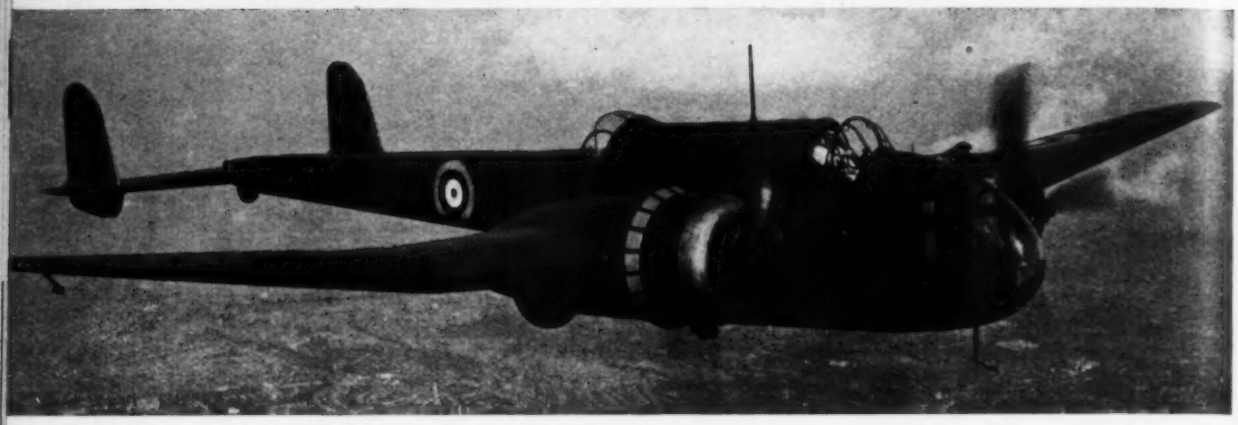
Apart from militarised versions of their civil types, notably the Dragon and Rapide, the De Havilland Company have produced three models of special interest in the military field. These are the Tiger Moth trainer, the Queen Bee wireless-controlled target machine and the Don communications type.

The Tiger Moth is intended for *ab initio* training with economy not only in outlay but in time. It can be used for instruction in fighting (with a camera gun), aerobatics, bombing, the use of wireless and photographic apparatus, reconnaissance and blind- and night-flying.

Essentially it is a two-seater biplane with staggered wings. The fuselage is of welded steel construction and the wooden wings are swept back, offering, incidentally, excellent outlook from both cockpits and facilitating exit. Full dual control is normally installed and the front windscreen is easily detachable so that the machine may be used as a single-seater with the front cockpit covered by a detachable lid. Low-pressure wheels are normally fitted, but skis or floats may be easily substituted.

As a light single-seater fighter the machine may be

The Handley Page Harrow bomber is fitted with Bristol Pegasus engines and benefits from Handley Page slots and flaps. It is capable of about 200 m.p.h.



In current production at the Handley Page works, the Hampden (above) is a very fast, highly manœuvrable, and well defended bomber.

armed with a synchronised machine gun or eight 20 lb. bombs.

Data for the landplane version loaded to 1,650 lb. are: Top speed, 110 m.p.h.; maximum range, 460 miles; stalling speed, 43 m.p.h.; take-off run, 119 yards; climb to 5,000ft., 7½ min.; service ceiling, 15,800ft.

The Queen Bee wireless-controlled target is structurally similar, but is equipped with secret apparatus.

The Don monoplane was originally designed as an advanced trainer, but is actually being supplied to the Air Ministry as a communications machine. This type is a low-wing monoplane fitted with the D.H. Gipsyking (or Gipsy Twelve) inverted vee-twelve air-cooled engine giving 525 h.p. for take-off. The machine is a three-seater with dual control. Structurally the outer sections of the wing has two box spars and ply covering; the centre section is of composite construction.

Data are: Span, 47ft. 6in.; length, 37ft. 4in.; height, 9ft. 6in.; wing area, 304 sq. ft.; wing loading, 21.5 lb./sq. ft.; power loading (take-off), 12.4 lb. h.p.; top speed, 213 m.p.h. at 8,750ft.; cruising speed, 192 m.p.h. on 62 per cent. power at 11,000ft.; range at cruising speed, 890 miles; weight empty, 5,050 lb.; gross weight, 6,530 lb.

The De Havilland Aircraft Co., Ltd., Hatfield, Herts.

FAIREY

The Fairey Battle single-engined bomber was one of the first modern monoplane types to be adopted by the R.A.F. and is now in large scale production not only at the Fairey works but in the Austin shadow factory. Several Battles have been supplied to the Belgian Air Force.

Arranged as a low-wing monoplane, the Battle has its

Capable of 335 m.p.h. when carrying a heavy military load, including eight machine guns, the Hawker Hurricane single-seater fighter is already extensively used by R.A.F. squadrons. The engine is the Rolls-Royce Merlin II. Above is a view of the Nash and Thompson power-driven turret on a Hawker Demon two-seater fighter.

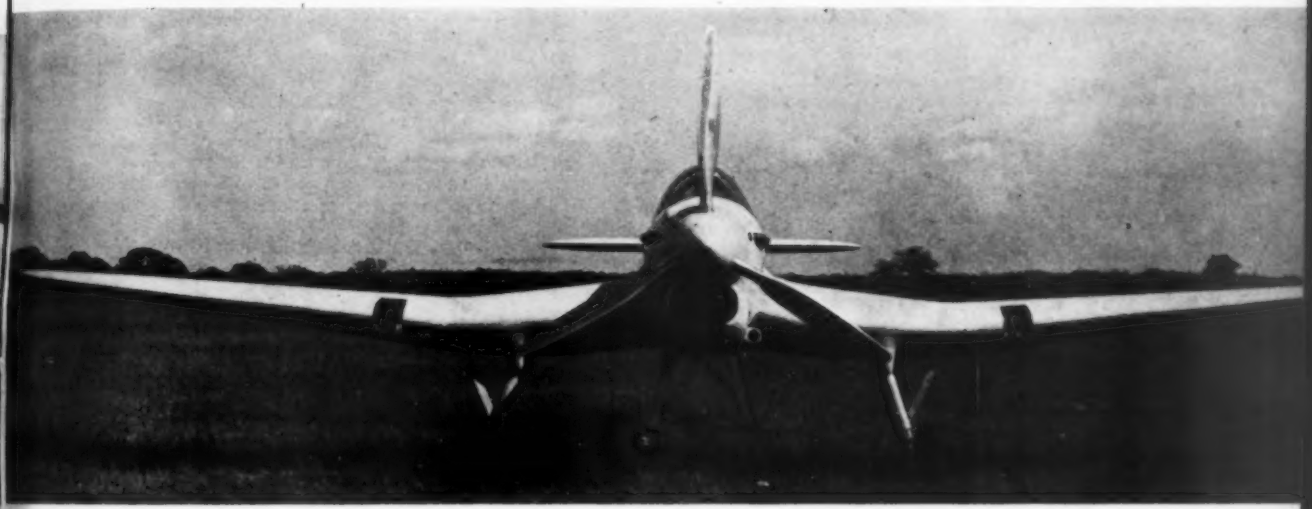
A standard *ab initio* trainer in the R.A.F., the Miles Magister (Gipsy Major) reproduces many of the characteristics of larger and faster types.

wing stubs built integral with the fuselage. The wing is of two-spar construction with girder type spars at the roots and flanged beams in the outer section. The stressed skin is riveted to stringers and flanges on the ribs. Split trailing-edge flaps extend on each side of the machine from the ailerons to the fuselage.

The oval section fuselage is in two parts, the former being of steel tube construction and the rear having transverse frames and Z-section stringers with a smooth skin covering.

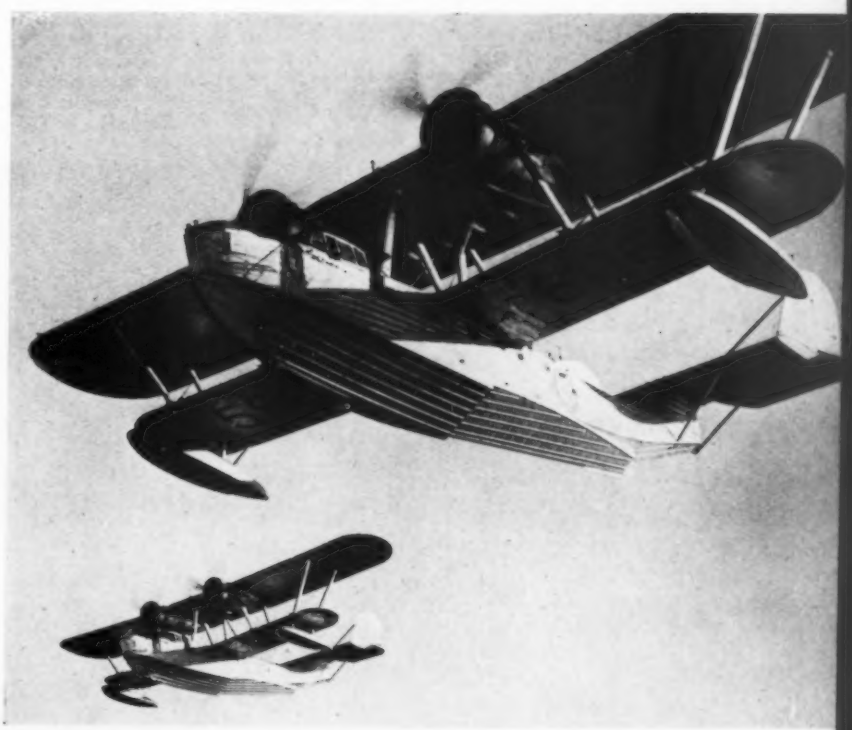
Each unit of the retractable undercarriage folds rearward, part of the wheel being within the wing and part faired externally.

The standard power plant is the Rolls-Royce Mer



Adopted by the R.A.F., the Miles Kestrel trainer has very beautiful lines and a high performance. This is probably the fastest training aircraft in the world.

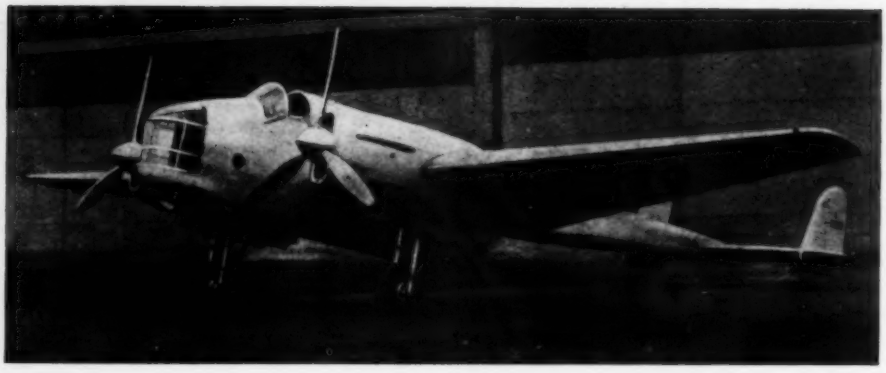
The Saro London flying boat (right) is in service with the R.A.F. and is now fitted with Pegasus X engines. It is very seaworthy and roomy.



lin II vee-twelve engine which is carried on a welded steel-tube mounting. The radiator is of the ducted type, placed forward of the centre section. A three-bladed De Havilland v.p. airscrew is standard equipment.

A crew of two or three may be accommodated. Armament comprises a fixed Browning gun in the starboard wing and a free gun on a special mounting in the rear cockpit. Bombs are carried in four cells in the wing. Radio and night flying equipment are standard.

Although employed by the Air Force solely as a bomber, the Battle has obvious applications as an attack machine with more gun power than the standard R.A.F. type.



The Hereford bomber, the prototype of which is seen on the left, is basically of Handley Page design, but is built by Short and Harland. Napier Dagger VIII engines are installed.

The figures are: Span, 54ft.; length, 52ft. 2in.; height, 15ft. 6in.; wing area, 422 sq. ft.; weight empty, 6,647 lb.; weight loaded, 10,792 lb.; wing loading, 25.6 lb./sq. ft.; speed at sea-level, 210 m.p.h.; speed at 15,000ft., 257 m.p.h.; landing speed, 60 m.p.h.; climb to 10,000ft., 8 min. 24 sec.; service ceiling, 25,000 ft.; range, 1,000 miles at 16,000ft. and 200 m.p.h. At full throttle a range of 640 miles is obtainable.

A second Fairey type popularly called the "Baby Battle," but actually a very different aeroplane, is the smaller P.4/34 designed as a light bomber to an Air Ministry specification. This machine has the same engine as the Battle and has obvious applications as a heavily armed fighter, the speed being at least 280 m.p.h. The undercarriage of the "P.4" retracts inwardly.

The Fairey Swordfish two-three-seater torpedo-spotter-reconnaissance biplane with Pegasus engine is performing extremely well with units of the Fleet Air Arm. This type carries a very comprehensive equipment and may be operated as a seaplane.

A fourth Fairey type is the Seafox light two-seater reconnaissance machine designed for catapult operation from cruisers. This model is designed for easy maintenance and has two-bay biplane wings and a monocoque fuselage. Although small it is very seaworthy and, despite its comparatively low performance (the engine is the 375 h.p. Napier Rapier), has proved itself a highly useful type.

The Fairey Aviation Co., Ltd., Hayes, Middlesex.

GLOSTER

The most highly developed biplane fighter to be supplied in quantity to the R.A.F. is the Gloster Gladiator, which is still in production at the Hucclecote works. The Gladiator may be regarded as a development of the Gauntlet (Mercury VI) from which it differs mainly in having a more powerful engine, a heavier armament, single-bay wings, a cleaner undercarriage, and trailing-edge flaps.

The structure of the Gladiator features metal wings with two spars of high-tensile steel and duralumin ribs, the whole being fabric covered. Upper and lower wings carry Frise balanced ailerons. The fuselage is in three sections and is of built-up tubular construction.

One of the most interesting features of the Gladiator is the single-strut cantilever undercarriage embodying Dowty internally sprung wheels.

The standard power plant is the Bristol Mercury IX engine giving 840 h.p. (maximum) at 14,000ft. The fuel tanks are carried in the fuselage.

Of the four Browning machine guns, two fire through troughs in the sides of the fuselage, the other two being installed in fairings beneath the lower wings. Equipment includes night-flying gear and wireless transmitting and receiving apparatus.

The pilot's cockpit is situated aft of the trailing edge of the top plane and has a transparent enclosure with sliding roofs.

Figures for the Gladiator are: Span, 32ft. 3in.; length, 27ft. 5in.; wing area, 323 sq. ft.; weight loaded, 4,750 lb.; top speed, 250 m.p.h. at 15,500ft.; stalling speed, 63 m.p.h.; climb to 5,000ft., 2 min.; climb to 10,000ft., 4 min.; climb to 15,000ft., 6.5 min.; climb to 20,000ft., 9.5 min.

Last year the Gloster company produced a low-wing multi-gun fighter monoplane of stressed skin construction and designed to take the Bristol Mercury or Perseus engines. A characteristic feature of this machine—which

Long range, effectively disposed armament and great carrying capacity characterise the Short Sunderland flying boat as now being delivered to general reconnaissance squadrons of the R.A.F.

This side view of the Supermarine Spitfire multi-gun fighter reveals to a marked extent, the resemblance of the machine to Schneider Trophy racing seaplanes produced by the same company.

was built to specification F.5/34 and was known by that number—was the forward position of the fin and rudder in relation to the tail plane. The undercarriage retracted rearwards into the wing, leaving a portion of each wheel exposed. The tail wheel was also semi-retractable.

Data for this model are: Span, 38ft. 2in.; length, 32ft.; wing area, 230 sq. ft.

The Gloster Aircraft Co., Ltd., Hucclecote, Gloucestershire.

HANDLEY PAGE

Specialising in the manufacture of multi-engined bombers, Handley Page, Ltd., some months ago completed a large order for machines of the Harrow type and are now well under way with a contract for a later type known as the Hampden.

The Harrow is arranged as a high wing type with a fixed undercarriage. The wing is built up round a single girder featuring laminated duralumin flanges and diagonal and vertical tubular struts arranged in the form of an N-type truss. Handley Page automatic slots and slotted flaps are fitted on the outer section of the wing, the flaps being hinged along the trailing edge between the aileron and the fuselage and operated hydraulically.

The nose section of the fuselage has a duralumin framework and smooth sheet covering. Centre and rear portions are of tubular construction, the former with bolted joints and the latter being welded. The centre and rear portions are fabric-covered.

The monoplane tail has twin fins and rudders, the latter, like the elevator, being balanced.

The fixed undercarriage is of very clean design with large fairings for the wheels.

The standard power plant consists of two Pegasus XX supercharged engines which drive three-bladed De Havilland v.p. airscrews.

Data for the Harrow with these units are: Top speed, 200 m.p.h. at 10,000ft.; cruising speed, 163 m.p.h. at 15,000ft. on 54 per cent. power; stalling speed, 63 m.p.h.; service ceiling, 22,800ft.; range with normal bomb load at cruising speed, 1,250 miles.

The Hampden, although considerably smaller, actually carries a heavier bomb load for a greater distance at a higher speed than the Harrow. This machine has Pegasus engines—of the latest type—and has been designed as a mid-wing type. The most characteristic feature is the deep section of the forward portion of the fuselage, which accommodates the crew and most of the load, and the boom-like rear fuselage which supports the tail plane with its twin fins and rudders.

All three wheels of the undercarriage are retractable.

The highly tapered wing incorporates Handley Page slots and hydraulically operated trailing-edge flaps.

Guns are installed in the nose, on top of the fuselage, and at the rear of the box-like fuselage structure. All positions are very carefully shielded.

Dimensions are: Span, 69ft. 4in.; length, 52ft. 5in.; height, 14ft. 4in.

A version of the Hampden powered with Napier Dagger engines is mentioned under Short and Harland.

Handley Page, Ltd., Cricklewood, London, N.W.2

HAWKER

The outstanding success of the Hawker biplanes of recent years promises to be equalled, if not excelled, by the new monoplane types as typified by the Hurricane.

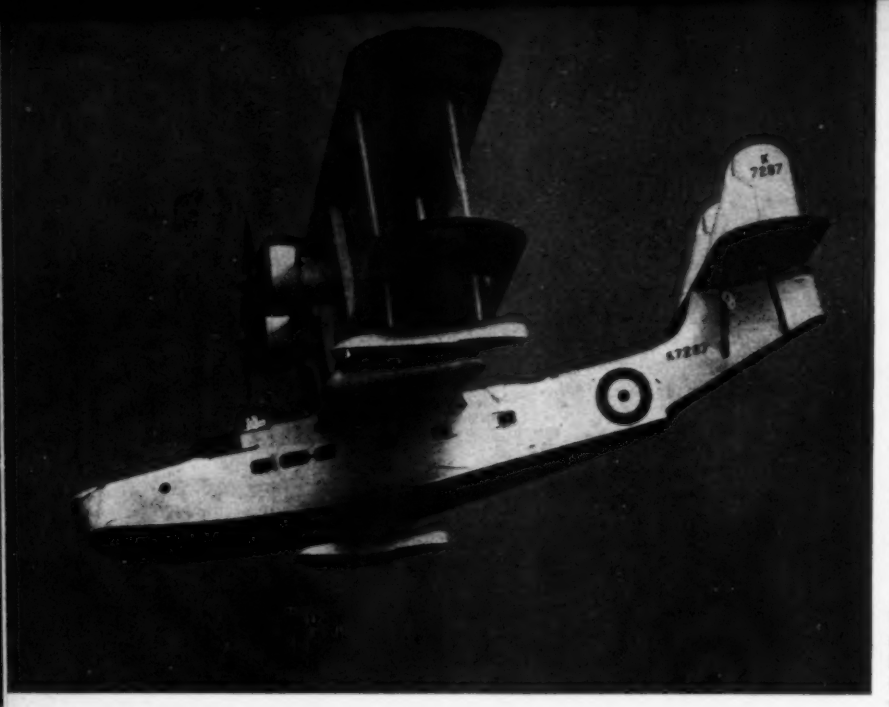
Certain of the biplanes are still in demand. These, of course, include the Fury single-seater fighter with its rather heavier and larger development, the Nimrod, for fleet work, the Osprey, Hind, Audax, Hector, Hardy, and Hart Trainer. The last six types were developed from the basic Hart design. Speeds of over 200 m.p.h. have been attained with Hinds fitted with Rolls-Royce Kestrel XVI fully supercharged engines. Other power plants installed have included the Bristol Pegasus and Mercury and the Armstrong Siddeley Panther.

The Hurricane, now in quantity production for the R.A.F., is a single-seater multi-gun monoplane fighter.

The wing construction of the Hurricane has been described as an ingenious adaptation of old methods to new requirements. The spars are bulbous, steel booms of polygonal section at top and bottom with a central web of flat sheet with circular lightening holes. The centre section, which is a single unit extending about 3ft. on each side of the fuselage, has solid webs stiffened by riveted-on vertical channels. An interesting fact is that the drag members are almost identical with the spars but are slightly smaller. These run zig-zag fashion between the spars forming the foundation of a tremendously strong and stiff structure. Ribs are of simple design with bracing members of circular-section tube.

Attachment of the fabric is, of course, an extremely important operation in view of the speed attained by the Hurricane. Briefly, the fabric is drawn into the channel of the rib and instead of being held in only a few places as in attachment by lacing, is held by the whole area of metal strips placed over each rib channel. The centre section has sheet metal covering.

Hydraulically operated flaps extend from aileron to aileron in three sections and Frise type ailerons are fitted.



Although of biplane layout, the Supermarine Stranraer flying boat has a really useful performance and great carrying capacity. The engines are Bristol Pegasus Xs.

The wheels of the undercarriage retract laterally in an inward sense and are perfectly faired when raised.

The Rolls-Royce Merlin II engine is mounted on a steel-tube structure and is cooled by a radiator in a scoop type housing situated under the belly of the fuselage.

Eight Browning machine guns are installed—four in each wing. Standard equipment includes night flying gear (with Harley landing lights), blind flying equipment and two-way radio.

Although a variable-pitch airscrew is not fitted as standard, the take-off run is very reasonable. Landing characteristics are said to be quite exceptionally pleasant for a machine of the Hurricane's type.

The latest data for the Hurricane as fitted with ejector type exhausts are: Maximum level speed, 335 m.p.h. at 17,500ft.; climb to 20,000ft., 9 min.; landing speed with flaps, 62 m.p.h. The loaded weight of the machine is in the neighbourhood of 6,000 lb., and sufficient petrol is carried for a duration of nearly 2 hours at full throttle. Other data are: Span, 40ft.; length, 31ft. 5in.; wheel track, 7ft. 10in.; wing area, (net) 231.5 sq. ft.

A Hurricane has lately been fitted experimentally with a De Havilland variable pitch airscrew.

Another monoplane type—the Henley two-seater bomber with Merlin engine—is now in production at the Gloster works as a high speed target-towing aircraft for the R.A.F. The fact that the machine has been chosen for this duty reflects in no way on its qualities, which are actually quite brilliant.

The Hawker Aircraft, Ltd., Canbury Park Road, Kingston-on-Thames, Surrey.

MILES

A very important production order was placed some little time back for the Miles Kestrel Trainer—a high-speed low-wing monoplane.

The fuselage of the machine is of wooden semi-monocoque construction incorporating between the cockpits a strong metal former built out to the window fairing line for the protection of the occupants should the machine nose over on landing.

The entire wing is ply-covered. All electrical leads and air lines are housed in ducts in the leading edge and are readily removable. Hydraulically operated flaps are fitted, the outer portion being depressed to an angle of approximately 23 deg. for take-off and 90 deg. for landing. Each cockpit has a control unit incorporating the rudder bar with its adjustment and a control column with brake attachment. All three systems are operated by push-pull tubes adequately stabilised by ball-races covered with rubber tyres. Elevator and rudder have damped trimming tabs with irreversible units placed as close to the tabs as possible. These tabs may be operated from either cockpit.

The engine is of a new type designated the Kestrel XXX and is resiliently mounted on a steel tubular structure which permits complete removal of the engine together as a unit with radiators, oil-cooler, header tank, etc. A low-drag cooling duct for water and oil systems is placed beneath the engine sump with a variable outlet controlled from the front cockpit.

Two 35-gallon fuel tanks are slung in the centre section near the root. These are readily removable through a door in the under surface and are connected with a large diameter fuel pipe running across the fuselage. An emergency hand pump capable of delivering 120 gallons an hour is installed.

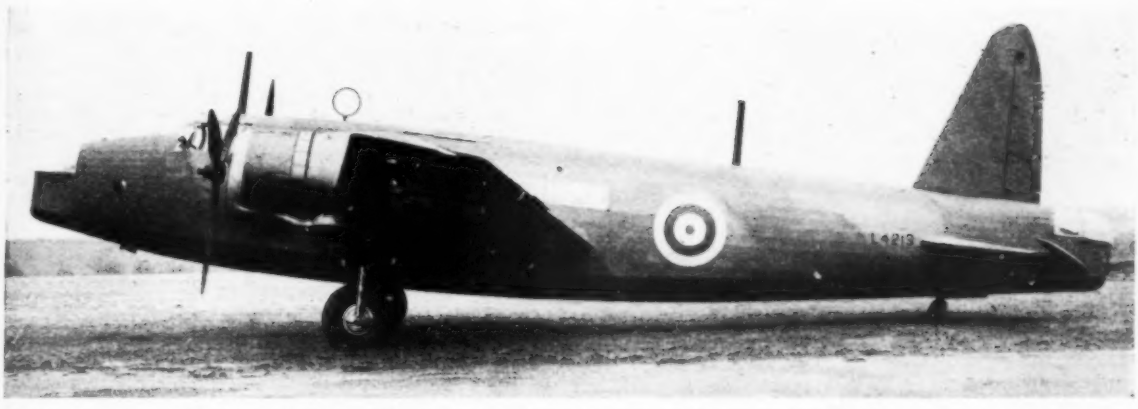
The oil system is of normal design and the tank is resiliently mounted on Silentbloc attachments. The tank has a partial circulator incorporated and the filter may be withdrawn through the top of the tank. For draining, a pipe is led to the side of the fuselage via a three-way cock in the tank sump. This is interconnected to the starting ignition switch.

The undercarriage retracts in two independent units and works in conjunction with a position indicator and warning hooter. Data for the Kestrel Trainer are: Span, 39ft.; length, 30ft. 5in.; wing area, 210 sq. ft.; and wheel track, 12ft. 3.5in. The following performance figures are estimated: Top speed at sea-level, 210 m.p.h.; at 10,000ft., 240 m.p.h.; at 15,000ft., 268 m.p.h.; climb to 15,000ft., 10 min.; cruising speed at two-thirds power at 15,000ft., 226 m.p.h.

The Miles Magister is a two-seater low-wing cantilever monoplane of wooden construction designed for *ab initio* training. The undercarriage is of a clean fixed type and the engine is the D.H. Gipsy Major. The construction follows normal Miles practice and the machine has vacuum-operated flaps.

The Magister is claimed to repro-

Suitable for a variety of naval duties, notably reconnaissance work from warships, the Supermarine Walrus, (Pegasus) has met with great success with the Fleet Air Arm.



Both the Vickers Wellesley (top) and the Wellington (below) are built on the Vickers-Wallis geodetic system, which gives a low structure weight. The Wellington is the more recent type and as will be seen has gun turrets in the nose and tail.

duce many of the characteristics of high performance military aircraft.

Figures are: Span, 33ft. 10in.; length, 25ft. 3in.; wing area, 176 sq. ft.; aerobatic weight, 1,825 lb.; top speed, 145 m.p.h.; landing speed, 45 m.p.h.; service ceiling, 18,ecoft.

Phillips and Powis Aircraft, Ltd., Reading Aerodrome, Reading, Berks.

SAUNDERS-ROE

The only product of this firm that it is possible to discuss at the moment is the well tried London twin-engined flying boat intended for open-sea reconnaissance, coastal defence and control, convoy and general purpose duties.

The construction of the wings is in metal, most of the stainless-steel spar fittings being machined from solid portions; the remainder of the structure is in duralumin or stainless steel.

In the hull the bulkheads are so arranged that any two of the three watertight compartments can be holed without loss of the boat. The bottom is constructed so that all curvature is eliminated, facilitating repairs. The plating is of open corrugated type over closely spaced transverse frames. Alclad is used throughout. There are three gun positions—in the bow, amidships and in the extreme tail. A heavy bomb load can be accommodated beneath the wings.

Standard engines are Bristol Pegasus Xs. These are mounted forward of the centre section of the top wing and drive fixed-pitch airscrews.

Spare engines and similar items can be carried on the hull decking, specially strong anchorages being provided. A torpedo can also be transported. The addition of such items has no effect on the handling qualities of the London.

Figures are: Span, 80ft.; length, 56ft. 9in.; wing area, 1,425 sq. ft.; gross weight, 18,400 lb.; top speed, 155 m.p.h. at 6,560ft.; service ceiling, 19,900ft.; take-off, 16 sec.; landing speed, 64 m.p.h.

Saunders-Roe, Ltd., Cowes, Isle of Wight.

SHORT

A prominent contribution to the new equipment of the R.A.F. is the Short Sunderland long-range military flying boat, developed in its essentials from the Short Empire type standardised by Imperial Airways.

Several Sunderlands have already been flown out to the R.A.F. base at Singapore, and some fast times have been made over long distances. One stretch of 1,250 miles was covered comfortably in eight hours.

The Sunderland differs from the Empire boat notably in the design of the hull, particularly in the region of the rear step. Power-operated gun turrets are installed in the bow and behind the rudder, and a very heavy bomb load may be carried, although the arrangements for stowing and dropping are still secret. The rows of portholes give an indication of the capacious interior. Actually, the Sunderland is probably the roomiest machine yet delivered to the Service.

Four Bristol Pegasus engines are installed. They drive De Havilland variable-pitch airscrews and are fitted with the standard Bristol gilled cowling.

It is believed that the Service equipment includes a very advanced wireless installation and repair facilities which make the boat practically a self-contained unit on extended cruises.

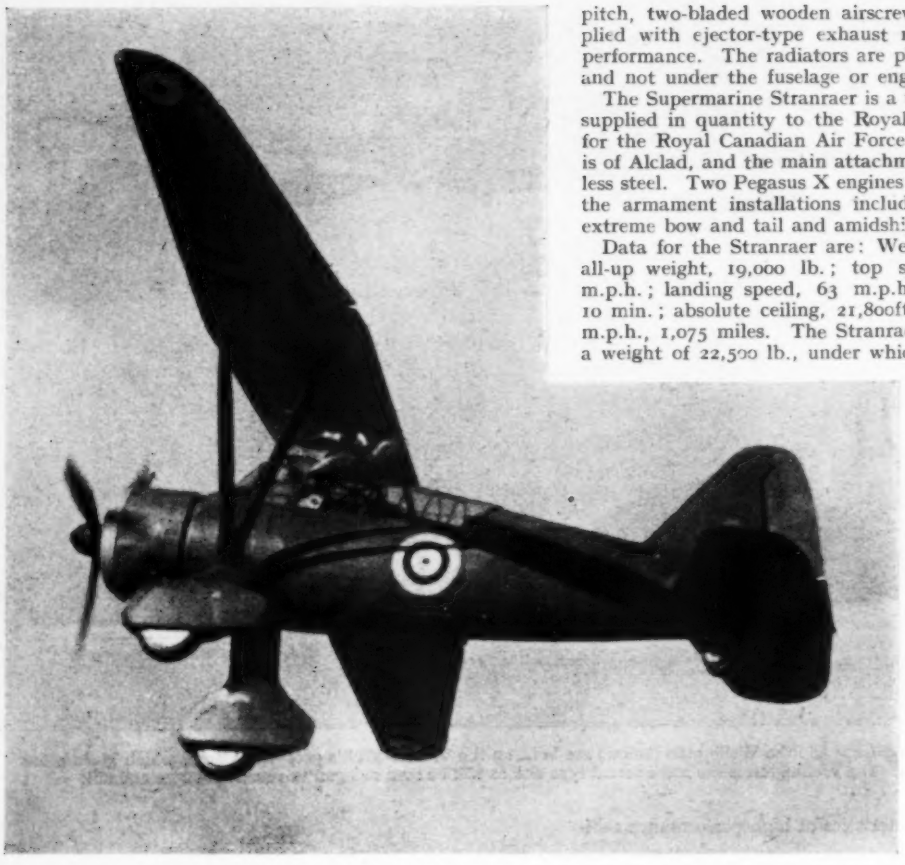
Performance figures are not available, though it is reasonable to suppose that the top speed is rather over 200 m.p.h.

Dimensions are: Span, 114ft.; length, 85ft.; and height, 33ft.

Although already standard equipment, the Sunderland makes an excellent showing against experimental prototypes lately produced abroad.

It has been reported that an order has been placed for landplane bombers using a wing structure similar to that of the Sunderland.

An earlier type of four-engined military flying boat—the Singapore III—is giving excellent service with R.A.F. general-reconnaissance units at home and abroad.



Excellent outlook for the crew and the ability to operate from confined spaces are but two of the outstanding qualities of the Westland Lysander army co-operation machine as supplied in quantity to the R.A.F. The engine is a medium supercharged Bristol Mercury.

This type has four Rolls-Royce Kestrel engines, and is capable of a top speed of 145 m.p.h.

Short Bros. (Rochester and Bedford), Ltd., Rochester, Kent.

SHORT AND HARLAND

Two types have been selected for initial production at the new Short and Harland factory in Belfast—a version of the Handley Page Hampden with Napier Dagger VIII engines, known as the Hereford, and the Bristol Bombay bomber transport.

The prototype of the Hereford is actually a conversion of an early Hampden, but production machines, it is believed, will embody all the new features of the Hampden as now going into service with the R.A.F.

Some notes on the Bristol Bombay appear under the heading "Bristol."

Short and Harland, Ltd., Belfast, Ireland

SUPERMARINE

So far as can be ascertained, the Supermarine Spitfire multi-gun single-seater fighter now in production is the fastest military machine used as standard equipment by any Air Force. This type has been selected for production in the new factory to be erected by Lord Nuffield; a thousand examples have been ordered from that source.

It is evident from an external study of the machine that advantage has been taken of much of the pioneer work done by the Supermarine Company in the design and construction of seaplanes for the Schneider Trophy race.

The lines are exceptionally graceful, and it is claimed that the technique utilised in the construction, which is of the stressed-skin variety, gives exceptional stiffness to wings and fuselage for a structure weight never before attained in this class of aircraft.

The engine is a Rolls-Royce Merlin II driving a fixed-pitch, two-bladed wooden airscrew. This engine is supplied with ejector-type exhaust manifolds which benefit performance. The radiators are placed beneath the wings and not under the fuselage or engine as is customary.

The Supermarine Stranraer is a twin-engined flying boat supplied in quantity to the Royal Air Force and ordered for the Royal Canadian Air Force. The hull of this type is of Alclad, and the main attachment fittings are of stainless steel. Two Pegasus X engines are normally fitted, and the armament installations include gun positions in the extreme bow and tail and amidships.

Data for the Stranraer are: Weight empty, 11,250 lb.; all-up weight, 19,000 lb.; top speed, at 6,000ft., 165 m.p.h.; landing speed, 63 m.p.h.; climb to 10,000ft., 10 min.; absolute ceiling, 21,800ft.; normal range at 110 m.p.h., 1,075 miles. The Stranraer can be overloaded to a weight of 22,500 lb., under which conditions, with normal and overload tanks, it can carry a military load of 4,000 lb. for 1,750 miles, taking off in about 25 sec.

Popular in the Fleet Air Arm as a spotter reconnaissance machine, the Supermarine Walrus (known in the Royal Australian Air Force as the Seagull V) is an amphibian flying boat with a single Bristol Pegasus engine driving a pusher airscrew.

Figures for the Walrus as fitted with a Pegasus VI engine of 680 h.p. are: Span, 45ft. 10in.; wing area, 610 sq. ft.; weight empty, 4,900 lb.; all-up weight, 7,200 lb.; top speed, 135 m.p.h. at 4,750ft.; landing speed, 57 m.p.h.; range, 600 miles at 95 m.p.h.

Supermarine Aviation Works (Vickers), Ltd., Hythe, Southampton.

VICKERS

Two bombers—both supplied in quantity to the Royal Air Force—are the first machines to be built according to the Vickers-Wallis principle of geodetic construction.

The first was the Wellesley single-engined type, suitable as a long-range bomber, torpedo carrier or general-purpose machine. Features of this machine include a wing of very high aspect ratio, built round a spar of duralumin tube with a profile structure of geodetic members and covered with doped fabric; an inwardly retracting undercarriage, separate cockpit enclosures for pilot and gunner and streamlined bomb containers beneath the wing.

As supplied to the Royal Air Force the standard power unit is the Bristol Pegasus XX, but the Pegasus XVIII and XXII models are also suitable.

Dimensions are: Span, 74ft. 7in.; length, 29ft. 3in.; wing area, 630 sq. ft. Performance figures are: Speed at 9,680ft., 228 m.p.h.; initial rate of climb, 1,200 ft./min.; absolute ceiling, 35,250ft.; landing speed, 57 m.p.h.; take-off run, 263 yds. Cruising at 158 m.p.h. a range of 2,590 miles is possible when carrying a useful bomb load.

The twin-engined Wellington is arranged as a mid-wing type and has power-driven gun turrets in the nose and tail with additional armament amidships.

There is a well-lighted cabin for the crew and a commodious pilot's cockpit. [*Concluded on next page.*

The engines are of the Pegasus type and may be assumed to be fitted with two-speed superchargers. The retractable undercarriage is of exceptionally clean design and folds rearwards into the engine nacelles.

Dimensions for the Wellington are:—Span, 86ft. 1in.; length, 61ft.; height, 18ft. 9in.

Vickers (Aviation), Ltd., Weybridge, Surrey.

WESTLAND

The Westland aircraft works are now concentrating on the production of a large number of Lysander army co-operation monoplanes for the Royal Air Force. This type is of particular interest not only from the military viewpoint but because of some unique aerodynamic and structural characteristics.

Arranged as a high-wing strut-braced monoplane, the Lysander offers excellent outlook for the crew, and thanks to its full equipment of Handley Page slots and flaps, is capable of operating from very confined spaces.

Construction entails extensive use of extruded light-alloy sections. The undercarriage may be regarded as an inverted U-tube in the form of an aluminium alloy extrusion with rounded corners. This carries Dowty internally sprung wheels and two fixed Browning machine guns, the ammunition for which is fed down the leg. Small stub wings may be fitted to the undercarriage for the attachment of bombs.

The engines in the first batches of Lysanders are medium-supercharged Bristol Mercury XIIs of 890 maximum h.p., but later machines will be fitted with Perseus sleeve-valve engines.

Equipment includes night-flying gear, two-way wireless and a hook for picking up messages. The observer is provided with a free machine gun.

The Handley Page leading edge slots extend over the entire span of the wings, the inner portion being a lift slot while the outer portion is a normal tip slot. The inner slot is connected by levers and linkages to the trailing edge flaps and it is arranged that by a suitable choice of take-off attitude the pilot can cause the lift flaps to be lowered to the desired angle.

Data for the Lysander with Mercury XII engines are:—Span, 50ft.; length, 30ft. 6in.; wheel track, 9ft.; wing area, 260 sq. ft.; weight empty, 4,065 lb.; weight loaded, 5,920 lb.; speed at 10,000ft., 229 m.p.h.; speed at 20,000ft., 212 m.p.h.; minimum flying speed (engine on), 55 m.p.h.; rate of climb at sea level, 1,650 ft./min.; service ceiling, 26,000ft. At a cruising speed of 150 m.p.h. the range is 600 miles. With full load the take-off distance to clear a 50ft. obstacle is 230 yards.

Westland Aircraft, Ltd., Yeovil, Somerset.

PITY THE POOR DESIGNER!

(*Continued from page 354*)

Even when his main aerodynamic design has been settled the designer is not out of the wood. Although the two aspects of design—aerodynamic and structural—are quite distinct, they have a close inter-relationship, and at many points they are in conflict, calling once more for compromise. The successful designer is he who can assess relative values most accurately and evolve from his estimate of them the best compromise.

This need for weighing pros and cons is constantly cropping up. It manifests itself in scores of ways. The choice between stressed-skin construction and girder construction with fabric covering is made more difficult by the unpleasant fact that the designer has to bear in mind the equipment of the shops and the experience of the work-people in one type or the other. He also has to consider whether, at the speeds contemplated, he can be sure of finding ways and means of making his fabric "stay put." Ultimately this consideration may compel him to disregard the fact that his firm has not previously done stressed-skin work, and to insist on the change-over being made, irrespective of the cost and delays involved.

From the larger general considerations the designer next has to descend to minute details. If he uses stressed-skin covering, shall it have flush riveting, or will it suffice if he uses ordinary projecting rivet heads? In deciding this, the designer has to bear in mind that flush riveting will add a little to his speed, at least, if used over the first third of the wing chord or so. From there to the trailing edge it is not quite so important. Will the two or three extra m.p.h. obtainable in this way be more important than possible delays in production caused by the slightly more difficult riveting process?

Again, shall he use lap joints or butt joints on his stressed-skin covering? Upon the choice will depend to some extent the type of internal reinforcement used, and this will affect the weight. If lap joints are used, should they face forward or back? Off-hand one would say the latter, but recent tests seem to have shown that if the edge of the sheet is rounded off, the forward-facing lap joint offers very slightly less drag than the other.

Although, as mentioned previously, the Air Ministry specification usually settles the choice of engine, the aircraft designer still has so to arrange the cooling that it is obtained with a minimum of drag. If the engines are of the liquid-cooled type, the designer has to decide where the radiator can be placed, how small he dare make it (depending upon the efficiency of his radiator arrangement), and how the fairing may be worked in with the retractable undercarriage (in the case of a twin-engined machine). If the engines are air-cooled, there is a choice between the long-chord cowling with controllable gills, the duct type in which air is taken in through the leading edge and released through the back of the engine cowling, or, finally, the type in which the air passes from the engine through a passage which gradually shrinks in depth but widens out in plan to form a fan shape, the air escaping through a narrow slit in the trailing edge of the wing.

It goes without saying that there are hundreds of other problems which the aircraft designer has to solve, but sufficient indication has been given of the kind of thing with which the designer is faced every day of his life to show how unlikely it is that anyone not familiar with the circumstances could appreciate the difficulties.

The designer's end of the problem is only half the story. When the drawings have gone to the shops a new set of problems arise with which the designer is not so intimately concerned (assuming that he has in the first instance consulted the shops while planning his structural details).

Engineering Inspection in the Midlands

TO meet the needs of its growing membership in the Midlands, the Institution of Engineering Inspection is establishing two new branch centres, one at Manchester and the other at Coventry.

The inaugural meeting of the Coventry and District Branch will take place to-morrow, October 28, at 7.30 p.m. at the Coventry Technical College. The chair will be taken by Mr. C. Grad, chief inspector at the Rugby works of the British Thomson-Houston Co., Ltd. Lt.-Col. H. W. S. Outram, Director of Aeronautical Inspection at the Air Ministry and President of the Institution, will be the principal speaker.

Col. Outram will also address the opening meeting of the Manchester Branch on November 8. On this occasion the meeting will be held at Manchester College of Technology at 7.30 p.m. with Mr. L. Nicholson, chief inspector of Metropolitan-Vickers Electrical Co., Ltd., in the chair.

On each occasion Col. Outram will explain the Council's plans for the development of the new branches and will outline the general purposes of the Institution. The meetings will be open to all interested in technical and engineering inspection.

Private Flying

FROM the CLUBS and SCHOOLS

LONDON

THE flying time for last week amounted to 99 hr. Messrs. R. J. Salmon and H. M. Pickard made their first solo flights. Mr. F. R. Pickard completed his "A" licence tests.

BORDER

Several C.A.G. members are now approaching the solo stage. Cross-country flights were made during last week to Dublin, Grimsby and Newcastle.

ROMFORD

Dual instruction during last week amounted to 75 hr. Messrs. George Jennings, Ramsay Longland and Dr. Keithley successfully accomplished their first solo flights.

STRATHTAY

For the week ending October 16 30 hr. of flying by the club were recorded. Mr. A. J. Cook has passed his "A" licence tests. The club's first C.A.G. soloist is Mr. A. G. Mackay, who achieved this distinction after 3¼ hr.

YORKSHIRE

The C.A.G. section of the club has 169 members, while approximately 1,000 applicants are in the course of being interviewed. This section has now flown 168 hr. since September. A new hangar and offices are being completed.

NEWCASTLE

Over 100 C.A.G. members attended a lecture on navigation at Nellist Nautical School recently. Other lectures are being arranged. Club flying for the week ending October 15 amounted to 42 hr., of which 34 hr. were on C.A.G. work.

BRISTOL

Thirteen new members have joined the club recently. Last week the club took delivery of a new Wicko. On October 29 a Tramps' Party will be held, starting at 7.30 p.m. The C.A.G. list has closed with 700 applications.

REDHILL

During last week Messrs. F. Wills, H. J. Heaton, H. Beot, P. C. V. Joslin, L. S. Berry, L. J. Richards, D. F. R. Emus, L. W. Simpson, L. D. R. Dunsford, F. C. Mackenzie and A. R. Jamieson went solo. The flying time for the week amounted to 113 hr.

CINQUE PORTS

Flying began in real earnest last week after the club's fortnight's holiday. During the week 53 hr. were flown. Messrs. S. R. Clowes, Miss Van den Bergh, Mr. J. P. Smith and Col. M. C. Demsey have passed their "A" licence tests. Mr. J. H. Stigner went on his first solo flight.

HERTS AND ESSEX

Flying time during the last fortnight amounted to 145 hr. Mr. R. E. Ebsworth, a C.A.G. member, has gone first solo. Night flights were made by Messrs. P. C. Ramachandran and J. G. Pathare. Messrs. R. Canning and S. I. D. Gasper have joined the club as new members.

NORFOLK

In connection with the Norwich Civic Week, the Club will organise a Civic Air Day during the course of to-day, October 27, when a flight of Hawker Hurricanes will take part in a special programme. Twenty hours were flown by the club last week, while C.A.G. members flew 25 hr. It has been decided that C.A.G. flying rates at week-ends will be the same as on week-days—5s. per hour.

SHOREHAM

Over 50 hr. were flown during the week. Mr. P. Rankine and Mr. S. A. C. Sibley, both of whom are C.A.G. members, have qualified for their "A" licences.

MARSHALL'S

Messrs. Leaf, Jacob, Standen and Robertson have joined the club as new members. The total flying time last week amounted to 112 hr. Mr. Ramsay has passed his "A" licence tests and Mr. Peters has gone solo. Both are C.A.G. members.

HANWORTH

Over 123 hr. were flown during last week. Mr. K. Wallis and Mr. I. Cantle went on their first solo flights. Messrs. A. Landau, F. Lister, L. Clark and C. Campo have joined the club as new members. Dr. P. Spence and Messrs. G. Royston, M. Sutherland and A. Worby have passed their "A" licence tests.

READING

The club's annual dance will be held at the Falcon Hotel on November 25, starting at 10 p.m. Earlier that evening a dinner will be held for flying members only, starting at 7 p.m. Tickets for the dinner and dance will be 10s., or 5s. for the dance only. Mr. G. Baker became the club's first C.A.G. soloist last week.

MADRAS

Rain during September adroitly avoided interfering with the club's programme. Mr. Duraisami won the Raja I. V. Krishna Rao Cup, with Mr. W. Parthasavathy placed second in the competition. Mr. Mohamed Ismail became the club's first Muslim to fly solo, while Messrs. Mathews and Balasingham have passed their "A" licence tests.

BEDFORD

Messrs. K. F. Jolly, C. H. Mallinson, A. E. Broadhurst, E. H. Peet, F. M. Phillips and P. A. Hill have joined the club as new members, while Messrs. R. M. Dixon and M. J. Tyssen have gone solo. Mr. E. H. Peet has passed his "A" licence tests. The Duke of Bedford has presented the club with a framed portrait of the late Duchess of Bedford.

BROOKLANDS

During last week 103 hr. were flown by the club. Mr. North went on his first solo flight, while Mr. Kohler has passed his "A" licence tests. Messrs. Smallman, Moynihan and Gosling have accomplished their "B" licence night flights. Mr. C. N. Bishop won the Hart Trophy landing competition last week-end. Mr. Houlder was placed second. Forty boys have joined the Air Defence Cadet Corps and £400 has been subscribed to the fund.

C.A.G. Uniforms

SOME time ago it was announced that Civil Air Guard members would be expected to wear a distinctive uniform, and this has now been approved by the Air Ministry. As originally suggested, it is an R.A.F. blue one-piece boiler suit, and those members who have qualified for their "A" licence will wear an appropriate "wings" badge.

Actually, 5,000 of these uniforms have been ordered—a figure which gives a good indication of the number of pupils which is officially expected to start training during the first twelve months. The cost of the entire kit, including helmet and earphones, will be 27s.

Forthcoming Events

OCTOBER

Thurs., 27th. R.Ae.S. Portsmouth Branch Debate: "Wood v. Metal"; 7 p.m., Airspeed Social Club, Copnor.

Thurs., 27th. Norfolk and Norwich Aero Club: Norwich Civic Air Day.

Fri., 28th. Institution of Engineering Inspection: Opening of Coventry Branch; Principal Speaker, Lt. Col. H. W. S. Outram, C.B.E., T.D., A.R.S.M., F.R.Ae.S., A.M.I.E.E.; 7.30 p.m., Coventry Technical College.

NOVEMBER.

Thurs., 3rd. R.Ae.S. Lecture*: "The Meteorological Problem of the North Atlantic," by Capt. F. Entwistle, B.Sc.

Tues., 8th. R.Ae.S. Students' Section Lecture†: "Wind Tunnels," by E. A. Wright.

Tues., 8th. R.Ae.S. Isle of Wight Branch Lecture: "Aircraft Instruments," by Sqn. Ldr. Saker.

Tues., 8th. Institution of Engineering Inspection: Opening of Manchester Branch; Principal Speaker, Lt. Col. H. W. S. Outram, C.B.E., T.D., A.R.S.M., F.R.Ae.S., A.M.I.E.E.; 7.30 p.m., Manchester College of Technology.

Wed., 9th. R.Ae.S. Lecture*: "American Aircraft," by T. P Wright, F.I.Ae.S., F.R.Ae.S.

Wed., 9th. R.U.S.I., Lecture; "The Spanish Civil War," by Wing Cdr. A. W. H. James, M.C., M.P.; 3 p.m., Royal United Service Institution, Whitehall.

NOVEMBER (Cont.)

Thurs., 17th. R.Ae.S. Lecture*: "The Work of the D.V.L.," by Dr. F. Seewald.

Thurs., 17th. R.Ae.S. Coventry Branch Lecture: "Ice Formation," by E. Taylor, Liberal Club, Union Street, Coventry.

Fri., 18th. Brooklands Four-club Annual Dinner and Dance, Grosvenor House, London.

Tues., 22nd. R.Ae.S. Students' Section Lecture†: "Meteorology," by F. Entwistle, B.Sc.

Tues., 22nd. R.Ae.S. Isle of Wight Branch Lecture: "Future Development of Aircraft Construction," by Dr. Roxbee Cox.

Wed., 23rd. R.U.S.I. Lecture: "Influence of Aircraft on Land Operations," by Sir Arthur Willert, K.B.E.; 3 p.m., Royal United Service Institution.

Fri., 25th. Reading Aero Club: Annual Dance (10 p.m.) and Flying Members' Dinner, Falcon Hotel, Reading.

Fri., 25th. Strathtay Aero Club: Annual Ball, Salutation Hotel, Perth.

Fri., 25th-Sun., Dec 11th Paris Aero Show with Air Transport Congress.

Tues., 29th. Institute of Transport: Brancker Memorial Lecture—"Development of Air Mail," by D. O. Lumley, O.B.E.; 6. p.m., Institution of Electrical Engineers, Victoria Embankment, London, W.C.2.

* All these lectures take place at 6.30 p.m., at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1.
† All these lectures take place at 7 p.m. in the R.Ae.S. Library, 7, Albemarle Street, London W.

BRITISH SPORT and TRAINING TYPES

Private-owner, Club, C.A.G. and Other Trainers Reviewed

(Illustrated mainly with "Flight" Photographs)

ARPIN

AS the first machine in this country to be designed around the tricycle undercarriage the Arpin Pusher is of particular interest. More recently the prototype has been in use as a test bed for Mr. Maclaren's "crabbing" undercarriage, the principles of which were recently described.

The company's next move will be to install a Cirrus Minor engine in place of the original Salmson which was used for the preliminary work, and a new nacelle is being designed around this unit.

The construction of the Arpin is of wood with a stressed-ply wing, and the tail is carried on two cantilever booms with twin rudders. In designing the machine Mr. Arpin has paid special attention to the provision of an outstandingly good field of view for the pilot, who sits in the forward of the two tandem seats, and to the layout of a three-wheel undercarriage which will be capable of taking any possible taxi-ing and landing loads. The upward movement of the legs is more than ample, but the main features of the undercarriage are in the width of the track and the length of the wheelbase. The former gives good cross-wind stability and the latter prevents the pitching motion which is apparent in the majority of short-wheelbase tricycle types.

ARPIN data with Cirrus engine:—Span, 31ft. 6in.; length, 23ft. 5in.; all-up weight, 1,350 lb.; maximum speed, 115 m.p.h.; cruising speed, 101 m.p.h.; and rate of climb, 800 ft./min.

Makers:—M. B. Arpin and Co., Longford, West Drayton, Middlesex. (*Colnbrook* 189.)

The Arpin pusher, shown here in prototype form, was the first machine in this country to be designed around the tricycle undercarriage. In production form it will be fitted with a Cirrus Minor engine.

AVRO

THE Avro Cadet, though it is not at present in production, may still be considered as a type available for primary and aerobatic training. It is, in fact, a scaled-down version of the Avro Tutor (and 626), which, following the old 504, have long been standard training types in the Service. Several Cadets are in use at different schools and clubs, and this type possesses, like its larger brothers, all those characteristics which make the tractor biplane such a pleasant type when flying for flying's sake.

Although scaled-down in overall size, very little has been lost in roominess by comparison with the Tutor, and the Cadet may be considered as the result of an endeavour to give full-scale features with the economy necessary for club use. The engine is a seven-cylinder Genet Major giving, at 2,200 r.p.m., 150 h.p., which is ample for the most advanced aerobatic manœuvres.

The fuselage of the Cadet conforms to the usual Avro practice and is of welded steel tube with wood fairings to give it shape, while both wings and tail units are of normal wood construction. In order to provide a good view from the front as well as from the rear seat the top wing is exaggeratedly staggered, a fact which also permits easy exit with a parachute (if necessary) from the front seat. The Cadet was one of the first light aeroplanes to be fitted with brakes and with a fully castoring tail wheel,

though for training work the machine is usually fitted with the more normal tail skid.

CADET DATA:—Span, 30ft.; length, 24ft. 9in.; all-up weight, 2,000 lb.; weight empty, 1,286 lb.; maximum speed, 116 m.p.h.; cruising speed, 100 m.p.h.; landing speed, 43 m.p.h.; rate of climb, 700 ft./min.; service ceiling, 12,000ft.; and cruising duration, 3.25 hr.

Makers:—A. V. Roe and Co., Ltd., Newton Heath, Manchester, 10. (Collyhurst 2731.)

CHILTON

THE single-seater type of machine has always tended to have a doubtful reception amongst the prospective purchasers, but for those who require such a machine the Chilton monoplane certainly possesses a remarkable performance even when fitted, in its standard form, with a Carden-Ford engine of only 32 h.p. With this unit the maximum speed is 112 m.p.h., and a genuine cruising speed of 100 m.p.h. can comfortably be held.

Nor has this performance been obtained at the cost of safety from the point of view of the inexperienced pilot. The Chilton's characteristics even at low speeds are very normal and, indeed, better than the average.

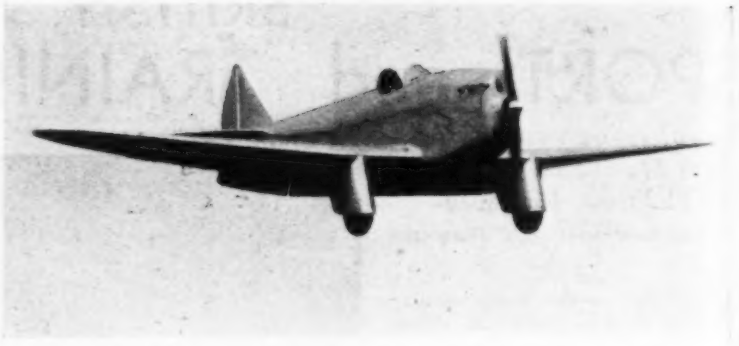
Naturally enough, every effort has been made to make the design a clean one, and the process of approaching and landing is simplified in these circumstances by the fitting of mechanically operated split flaps. The construction is of stressed plywood, and the wide-track undercarriage has a travel of four inches. The machine can be flown without goggles and even without a helmet, and there is ample room in two luggage compartments for light luggage.

When fitted with a rather more powerful engine the performance is even more remarkable. With a 44 h.p. Train, for instance, the maximum speed goes up to 125 m.p.h. and the rate of climb to 1,000 ft./min.; while the range is reduced only from 500 to 400 miles. In this case, however, extra tanks can be carried to increase this range to 1,000 miles. In the spring, when this engine has become available, the designers hope to fit a Cirrus Midget engine, which will convert the machine into one of relatively high performance and make it especially suitable for aerobatic training.

A somewhat larger machine is now under construction, but no details are yet available.

CHILTON (Ford engine) data:—Span, 24ft.; length, 18ft.; all-up weight, 640 lb.; weight empty, 398 lb.; wing-loading, 8.3 lb./sq. ft.; maximum speed, 112 m.p.h.; cruising speed, 100 m.p.h.; landing speed, 35 m.p.h.; rate of climb, 650 ft./min.; range, 500 miles; and price, £315.

Makers:—Chilton Aircraft, Hungerford, Berks. (Hungerford 26.)



Remarkable for its high top speed with a mere 32 h.p. for locomotion, the Chilton is nevertheless, easy and safe in its characteristics.

CHRISLEA

A NEW type to be considered as being particularly suited to C.A.G. requirements is the Chrislea, which is a side-by-side two-seater cabin low-wing monoplane. It was, however, designed, and the work of building the prototype had been started, before the details of the cheaper flying scheme had become public property.

Although, with the excellent view provided for both occupants and the normal flying characteristics which the initial test flights have shown, the Chrislea should make a good trainer, it was designed primarily to interest those private owners who require a good performance, comfort and reasonable roominess at economical first and later costs. The engine is a Walter Mikron II and this, it is expected, will be shortly put into production by an associated company.

The machine, which is known as the Airguard, has a number of interesting structural features. One of these involves an ingenious wing-folding arrangement in which a universal joint is fitted to the rear spar roots so that the wings can be pulled back and turned vertically before they are swung against the fuselage. In order to provide a good all-round view, the two top longerons of the box-type fuselage are dropped several inches at the rear of the cabin to give a low waistline where this is most necessary. The result is that the occupants appear to sit very high up behind a deep screen, and even on the ground it is possible for either occupant to see out on both sides. Manually operated three-position flaps are fitted on each side of the fuselage and extend out to the ailerons. The undercarriage is of the simple half-fork-type, compression being taken by eight rubber buffers, and it is claimed that either of these legs can be detached from the main spar and replaced in less than half an hour. There are dual rudder pedals and a centrally disposed control column.

Complete load and performance figures are not yet available, but the machine is to be sold for £550.

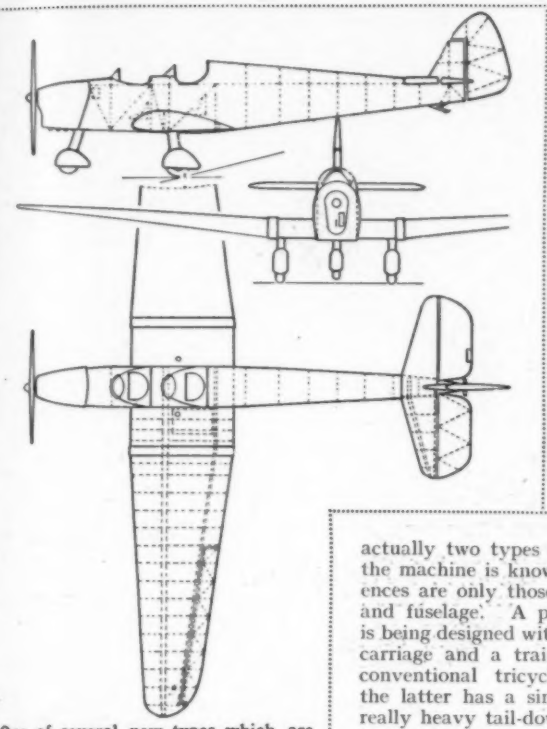
Makers:—Chrislea Aircraft Co., Ltd., Heston Airport, Middlesex. (Hounslow 2345.)

One of this year's arrivals—the Chrislea monoplane. When this photograph was taken at Heston the machine was going through its early tests and was neither painted nor spatted.

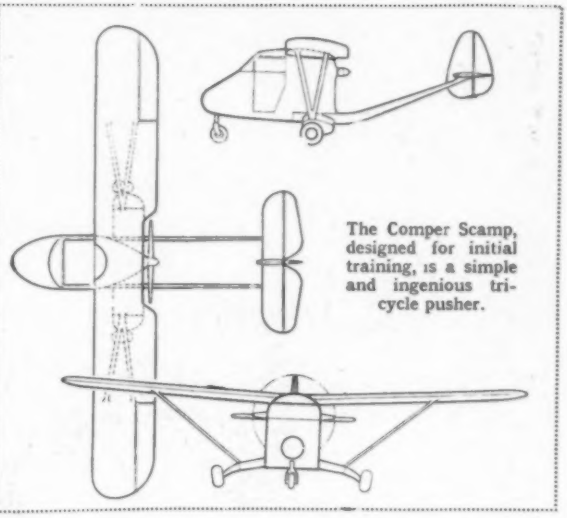
COMPER

INGENIOUS design might be expected in a machine from Flt. Lt. Comper's drawing board. Many years ago he produced one of the most successful and pleasant single-seaters, and recently he has been working on a new type for primary training. In this, which is known as the Scamp, every effort has been made to provide a type which will be as nearly foolproof as possible, and which, at the same time, will be cheap to manufacture.

The Scamp is a high-wing pusher with a tricycle undercarriage, and the prototype is being made, in single-seater form, by the College of Aeronautical Engineering at Brooklands.



One of several new types which are coming along for C.A.G. training, the Dart Weasel. In this general arrangement drawing it is shown in tricycle trainer form; another version will be available with a side-by-side seater cabin layout.



The Comper Scamp, designed for initial training, is a simple and ingenious tricycle pusher.

This will have a Praga engine, but the two-seater production model will probably be fitted with a Mikron.

As an example of ingenuity in design, the primary structure consists of two keel members which take all the load and to which the tail booms are attached. Another member lies transversely across this and is curved down on each side in stub wing form to take the undercarriage and the wing struts. The axles are attached to what may be described as the wing tips of the stub. The two longitudinal members carry the engine mounting and centre-section superstructure, as well as the cabin, which is designed for maximum view and convenience. At the nose is a simple castering wheel.

Performance figures have not yet been released, but the two-seater will have a span of 30ft. and an overall length of 18ft. 9in. It is hoped to sell the machine for about £400.

Makers:—Flt. Lt. Nicholas Comper, 2, The Ridgeway, Walton Bridge, Walton-on-Thames, Surrey. (*Tel.: Walton-on-Thames* 282.)

DART

AFTER successful work on a number of sailplanes and light aeroplanes (the best-known of which is probably the single-seater Kitten), Mr. A. R. Weyl, of Dart Aircraft, is now proceeding with work on a medium-sized two-seater. There are actually two types of the Weasel, as the machine is known, but the differences are only those of undercarriage and fuselage. A private-owner type is being designed with a normal undercarriage and a training type with a conventional tricycle undercarriage; the latter has a simple skid to take really heavy tail-down landings. The trainer also has open tandem seating arrangements, while the owner type, though still having full dual control, is a side-by-side-seater cabin machine.

In each case the wing is arranged in three parts—a centre section and two folding outboard wings—while the aerofoil section changes from root to tip with a wash-out similar to that of the Kitten, in which the stalling characteristics were very good. There is a single main spar and an auxiliary rear spar, while the wing is partly ply-covered. Mechanically operated split flaps and differentially operated ailerons are fitted. The tail group is fully cantilever and the trimming is carried out by means of tabs. In standard form the fuselage is a ply-covered box, but a steel tube structure has been designed as an alternative. An interesting feature of the training type is that the rear seat is raised to give the instructor a rather better view. In common with the increasing practice, the machine is designed to be flown from the front seat. The trainer is fully aerobatic.

Any engine up to 130 h.p. may be installed, but the performances given below are those with a 90 h.p. Cirrus Minor engine.

WEASEL data:—Span, 36ft. 1in.; length, 27ft. 6in.; all-up weight, 1,565 lb.; weight empty, 925 lb.; wing-loading, 9.1 lb./sq. ft.; power-loading, 17.3 lb./h.p.; maximum speed, 110 m.p.h.; cruising speed, 100 m.p.h.; stalling speed (without flaps), 45 m.p.h.; rate of climb, 600 ft./min.; and cruising range, 325 miles.

Makers:—Dart Aircraft, Ltd., High Street North, Dunstable, Beds. (*Dunstable* 429.)

DE HAVILLAND

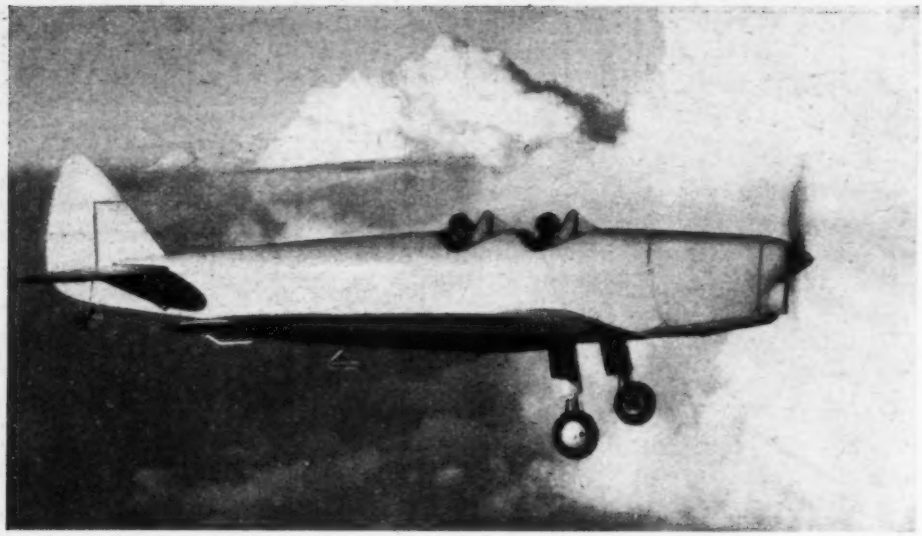
FOR some two years the development of a successor to the famous Moth series has been the special interest of Captain Geoffrey de Havilland, and the announcement of the Civil Air Guard scheme has merely served to speed up the work on the prototypes. The D.H.94, or Moth Minor, is a two-seater open or closed training and touring low-wing monoplane in which constructional simplicity, robustness and exceptionally good flying qualities have been aimed at.

In production form it will be fully aerobatic and for varied reasons, not the least important of which is the provision of a good take-off and climb, the makers have not attempted to obtain economy at the expense of necessary power. The engine will be the new 90 h.p. Gipsy Minor, which may be considered as a smaller and simplified version of the well-known Major.

The low-wing type of monoplane was chosen largely because it permits a maximum view and because the structural differences involved in the open and closed types need to be very small. In each form the Moth Minor has been designed to be flown without ballast from either seat, and the pilot or pupil will normally take that in front. There is a simple, but efficient, form of air brake, and the wings are arranged to fold for housing economy. The structure is straightforward, but no very intimate details have yet been published.

PROVISIONAL MOTH MINOR DATA:—Span, 36ft. 7in.; length, 24ft. 6in.; wing-area, 162 sq. ft.; all-up weight, 1,500 lb.; weight empty, 978 lb.; wing-loading, 9.3 lb./sq. ft.; power-loading, 16.7 lb./h.p.; maximum speed, 120 m.p.h.; cruising speed, 105 m.p.h.; cruising range, 300 miles; and price, £575.

With the introduction of the Moth Minor the Hornet Moth is now no longer in production, and the last of the most recent batch to be manufac-



Latest of the D.H. Moth series, the Minor will be produced in cabin and open two-seater forms. It is to be fully aerobatic and has been developed for safe and economical flying by pupils or owners. It is flown from the front seat.

tured has been sold. This machine was the result of a successful attempt to compromise between the varying needs of clubs and private owners, and its outstanding features are a short take-off with any load and a useful cruising range. Large numbers of them are in use and are likely to be so for many years to come.

The D.H.82 (Tiger Moth) is, of course, still in quantity production, and is used all over the world for *ab initio* and aerobatic training. Details and performance figures are given in the military aircraft section, since this is one of the standard Reserve School types, and, in modified form, as the Queen Bee, is used for anti-aircraft practice.

Makers:—The De Havilland Aircraft Co., Ltd., Hatfield Aerodrome, Herts.
(*Hatfield* 2345).

GENERAL AIRCRAFT

EARLIER this year General Aircraft took over the manufacturing rights for the C.W. Cygnet two-seater cabin monoplane, which is still this country's only all-metal, stressed-skin light machine. The company has decided to develop the machine into one in which stability and ease of handling will be the outstanding features. Already the tail has been modified to take twin fins and rudders, and in due course a tricycle undercarriage will be fitted.

The existing machine is powered with a Gipsy Major engine, but provision will be made for the fitting of a Cirrus Major or a Menasco C4S unit, according to the wishes of the purchaser. The structure of the Cygnet offers excellent opportunities for drop-hammer production, and by this means it is planned to manufacture a machine at a competitive price. The figures below refer to the prototype with the normal undercarriage and single fin and rudder.

The Cygnet's cabin has a transparent top extending to a low waistline, and the screen is of the one-piece moulded type giving a wide range of vision. Split flaps are, of course, fitted.

CYGNET data:—Span, 34ft. 6in.; length, 24ft. 3in.; all-up weight, 1,800 lb.; weight empty, 1,305 lb.; wing-loading, 10 lb./sq. ft.; power-loading, 15 lb./h.p.; maximum speed, 148 m.p.h.; cruising speed at 70 per cent. power, 130 m.p.h.; stalling speed, 48 m.p.h.; rate of climb, 900 ft./min.; service ceiling, 16,000ft.; and cruising range, 460 miles.

With a special eye on the Civil Air Guard market, General Aircraft are now proceeding also with the design of a simplified tricycle pusher in the true lightweight class. This machine will be known as the Cagnet and will be a two-seater low-wing machine. It will be powered with a 50 h.p. Pixie four-cylinder fan-cooled engine. It may be remembered that the Pixie was previously known as the Weir, and was fitted, also with fan-cooling, in the original jump-start Autogiro.

The construction of the Cagnet will be mainly of wood with the exception of the nacelle, which will be built of sheet-metal pressings. Both wings and tail will be ply-covered, and the latter is carried on two wood booms with twin fins and rudders to provide good directional stability and control at low speeds. The seating arrangement will be side by side, with a staggered layout for normal passenger carrying. At the present design stage no performance figures are available.

The well-known Monospar Universal, though of interest to private owners, is primarily a machine for transport work and is described in the appropriate section.

Makers:—General Aircraft, Ltd., London Air Park, Feltham, Middlesex (*Feltham* 2604).

HILLSON

ENTERING the world of aircraft construction with the Praga lightweight two-seater cabin monoplane, F. Hills and Son now have a trainer, designed specially for C.A.G. requirements in process of development. This machine, which will be known as the Helvellyn, will be a tandem two-seater monoplane on somewhat unconventional lines. No details are yet available for publication.

Recently the company carried out experiments with a two-seater cabin machine in which the controls had been simplified to an interesting degree. The Pennine, as it was known, had a fixed rudder with trimming tab, and all normal manœuvres were carried out by means of spoilers (taking the place of ailerons) on the leading edges and a normal elevator.

Recently taken over by General Aircraft, the Cygnet, which is an all-metal stressed skin medium-weight, will shortly be fitted with a tricycle undercarriage. The machine is shown here with its new twin-rudder assembly.

The pilot's controls consisted simply of a column and wheel with the usual throttle and trimming levers. Later on, when some of the many pupils now starting their training are ready for it, it is possible that the experiments will be continued and the machine be put into production.

Makers:—F. Hills and Sons, Ltd., Trafford Park, Manchester. (*Trafford Park* 1894.)

LUTON

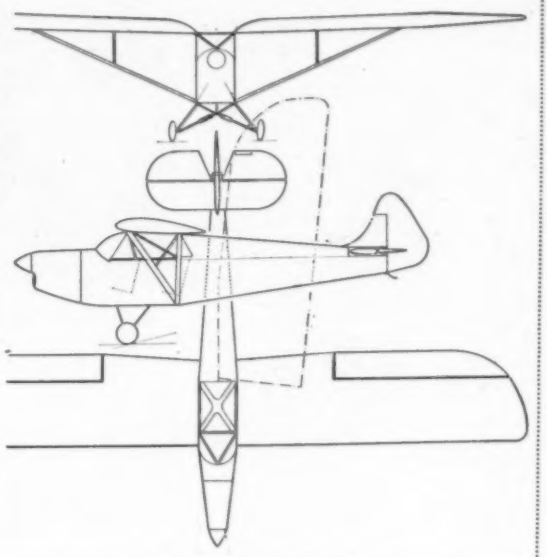
DURING the past few years Luton Aircraft have concentrated on the development of different lightweight machines for economical flying, and now that the C.A.G. scheme is in full swing there should be a market for the firm's latest project. This is a two-seater high-wing cabin monoplane in which the occupants sit in tandem. The first Luton Major, as the machine is known, is now nearly ready and should very shortly be making its initial test flights.

A strut-braced high-wing layout was chosen to provide stability and good flying qualities as well as a good field of view from the pilot's seat. The wings are arranged to fold by the removal in each case of a single pin and without the necessity for disconnecting the controls. Although the Major will be a cabin machine, the transparent sides are capable of removal for fine-weather flying.

The airframe is built up in spruce and plywood, with the lift struts and main stress carrying members of steel tube. The undercarriage will be of the split axle type, but this may, if required, be replaced by a form of tricycle gear. The first machine will be powered with a Walter Mikron engine, though suitable British units are likely to be fitted to later machines.

Provisional LUTON MAJOR data:—All-up weight, 1,030 lb.; weight empty, 600 lb.; maximum speed, 100 m.p.h.; cruising speed, 85 m.p.h.; stalling speed, 30 m.p.h.; cruising range, 320 miles; and price, £525.

Makers: Luton Aircraft, Ltd., Phœnix Works, Gerrards Cross, Bucks. (*Gerrards Cross* 2545.)



A G.A. drawing of the Luton Major, which may be considered as being the logical development of the single-seater Minor. This cabin machine, in which the occupants sit in tandem, should be flying within a few weeks.

MOSS

NEARLY two years ago the five brothers Moss produced their first machine, which was a tandem two-seater cabin monoplane fitted with a Pobjoy Niagara engine. With this they were probably the first to demonstrate the advantages of front-seat flying with the tandem arrangement. Since that time a sports model has been produced, and now work is going on with the development of a trainer type. This will be fitted with a Cirrus Minor engine, while the others will still be available with Niagara III engines.

In the design of all three an attempt has been made to compromise to the best possible advantage in the development of a suitable machine for the owner or the club. The wooden construction is simple, and the machine has a very fair performance with good and safe flying characteristics.

In trainer form the Mosscraft will be an open tandem two-seater, and once again the pupil (or pilot) will fly from the front seat, whence there is an exceptional range of view. The structure is stressed ply, with a single main spar, auxiliary rear spar, and box-type fuselage. The wings do not fold, but the outer sections are each attached by two bolts so that they can be quickly removed when necessary. As in the case of the prototype, the trainer will have mechanically operated split trailing-edge flaps in which the angle can be varied within wide limits.

The details below are for the trainer type, and it is sufficient to say that in cabin form the Mosscraft has a maximum speed of 130 m.p.h. and a cruising speed of 120 m.p.h., while the sports type has a maximum of 135 m.p.h. and a cruising speed of 122 m.p.h. The price of the cabin version is £750, and that of the sports type £695.

MOSSCRAFT data:—Span, 34ft.; length, 23ft. 3in.; all-up weight, 1,400 lb.; weight empty, 880 lb.; wing-loading 9.10 lb./sq. ft.; power-loading, 16.7 lb./h.p.; maximum speed, 127 m.p.h.; cruising speed, 110 m.p.h.; landing speed (flaps down), 36 m.p.h.; rate of climb, 640 ft./min.; service ceiling, 13,000ft.; cruising range, 560 miles; and price, £695.

Makers:—Moss Brothers Aircraft, Ltd., Chorley, Lancs (*Chorley* 2145).

The sports-type Mosscraft monoplane—another machine designed for front seat flying. A trainer version is in course of construction.

PERCIVAL

STILL being manufactured, though not now so well known as the Vega Gull, the Percival Gull was one of the first low-wing machines to be produced in this country. This machine, in which the pilot sits alone with two passengers behind him, may be fitted either with a Gipsy Six or a Gipsy Major, and even with the latter its cruising speed is usefully high. It is, of course, fitted with split flaps.

GULL data:—Span, 36ft. 2in. (13ft. 2in. folded); length, 24ft. 10in. With Gipsy Six engine: all-up weight, 2,450 lb.; weight empty, 1,480 lb.;

maximum speed, 178 m.p.h.; cruising speed, 155 m.p.h.; and cruising range, 640 miles. With Gipsy Major engine: all-up weight, 2,300 lb.; weight empty, 1,285 lb.; maximum speed, 155 m.p.h.; cruising speed, 133 m.p.h.; and cruising range, 760 miles.

Nowadays the Vega Gull, which was first introduced as a four-seater luxury version of the Gull Six, is usually fitted with a Series II Gipsy Six and v.p. airscrew. Pilots are becoming accustomed to the proper use of the throttle and mixture control with this unit, and a comparatively high-efficiency type, such as the Vega, can no longer be thought of as being one for the use of experts only. Like the Gull, this machine has a long list of distance and speed successes to its credit, the most recent being Broadbent's Australia-England flight in 5 days 4 hours 21 minutes in April of this year.

Both the structure and the finish have proved themselves in service over the last few years. The former is of wood with the wing built round two box spars of equal depth. The outer sections fold, and the centre section is built into the fuselage. The latter is of box structure with spruce members and plywood panelling, and has been designed so that the four-seater cabin is entirely free from struts or cross-members. The tail unit is fully cantilever. When a Series I engine is fitted a metal airscrew is used, while with a Series II engine either a D.H. or Ratier v.p. airscrew may be fitted. The cabin has a large door on each side, and the seating is arranged in two pairs, full dual control being provided for the front occupants. There is a baggage locker at the rear, and this is accessible from the outside.

VEGA GULL (Series II engine) data:—Span, 39ft. 6in.; length, 25ft. 4in. (folded 16ft.); all-up weight, 3,250 lb.; weight empty, 1,740 lb.; wing-loading, 16.5 lb./sq. ft.; power-loading, 16.4 lb./h.p.; maximum speed, 174 m.p.h.; cruising speed (7,000ft.), 170 m.p.h.; and cruising range, 660 miles. With a fixed-pitch airscrew the cruising speed is 150 m.p.h. at sea-level, and the range is 630 miles.

Although it is usually thought of simply as a racing machine, the Mew Gull may also be used for high-speed touring, for training, and even for mail feeder work, since its payload, in addition to the pilot, is much higher over long non-stop distances than one might expect. The type appeared in the 1934 King's Cup Race and was the first British civil aeroplane to have a top speed of more than 200 m.p.h. This year, it will be remembered, a specially cleaned-up version, in the hands of Mr. Alex Henshaw, won the race at an average speed of 236.35 m.p.h.

Fast, yet comparatively docile, the Percival Mew Gull can carry a useful load over long distances. Variations of the type have won the King's Cup in the last two successive years.

In spite of its comparatively high wing-loading, the Mew Gull's performance has not been obtained at cost of ease of handling. It can, in fact, be flown safely by any averagely competent pilot. Some of the speed and range figures in the data below are well worth close examination.

MEW GULL (Series II engine) data:—Standard type E.2.H.: Span, 24ft. 9in.; length, 20ft. 3in.; all-up weight, 2,125 lb.; weight empty, 1,150 lb.; payload in addition to pilot for range of 860 miles, 483 lb.; maximum speed, 235 m.p.h.; cruising at 7,000ft., 220 m.p.h.; landing speed, 60 m.p.h.; rate of climb, 1,700 ft./min.; and standard cruising range, 860 miles (maximum range, 1,500 miles at 220 m.p.h.). Racing type E.3.M.: Span, 22ft. 9in.; length, 20ft. 3in.; all-up weight, 1,850 lb.; weight empty, 1,150 lb.; payload in addition to pilot for 900 miles, 208 lb.; maximum speed, 245 m.p.h.; cruising speed at 7,000ft., 230 m.p.h.; landing speed, 60 m.p.h.; rate of climb, 1,800 ft./min.; standard cruising range, 900 miles (maximum range, 1,350 at 230 m.p.h.).

More recently Percivals have produced a high-performance twin-engined type. This is being used by several private owners, but it may be considered as a transport machine and is described in the appropriate section. *Makers:—Percival Aircraft, Ltd., The Airport, Luton, Beds* (*Luton* 2960), *and* 20, *Grosvenor Place, London, S.W.*1. (*Sloane* 3274.)

The latest of a series of Gulls—the Percival Vega Gull, a four-seater with a cruising speed of 170 m.p.h. at optimum height.

PHILLIPS AND POWIS

INCORPORATING various modifications and improvements resulting from experience with the Miles Whitney Straight, Phillips and Powis this year produced the Miles Monarch. Since the Straight was originally intended to be, as nearly as possible, an ideal type for the private owner, it is reasonable to suppose that the new Monarch must come even nearer to this ideal.

Basically the layout is very similar, with a side-by-side two-seater cabin and ample luggage accommodation on a tray immediately behind the seats. The structure is of stressed plywood. The Monarch, however, has a somewhat roomier cabin, and it is produced in two forms, one of which is a three-seater. The moulded one-piece screen is deeper and special attention has been paid to ventilation.

Mr. Miles was one of the first British designers, if not the first, to fit split trailing-edge flaps to his machines, and in the Monarch the vacuum-operated gear has been modified to incorporate an interesting safety device, which he calls a glide control. With this device a gate is provided to prevent the flaps from being raised completely in one movement, and the throttle is interconnected with the control so that, when it is necessary to use the engine suddenly either during or after the approach, the flaps move up automatically to the 20-degree position. There is, consequently, no sink and most of the drag is removed at the moment of opening the throttle. In its new form, too, the gear permits the flap position to be changed through an infinite variety of angles. In other words, the flaps are designed to give the best possible results both as lift-increasers and air brakes.

Magnesium alloy appears largely in

the construction of control items, and these, with other details on the machine, have received special consideration. Both performance and appearance has been improved by the use of a highly polished finish. The engine is, of course, a Gipsy Major, with a wooden airscrew for the two-seater and a metal airscrew for the three-seater.

MONARCH data:—Span, 35ft. 7in.; length, 26ft.; all-up weight (two-seater), 2,000 lb., (three-seater) 2,150 lb.; weight empty (two-seater), 1,360 lb. (three-seater) 1,390 lb.; maximum speed, 145 m.p.h.; cruising speed at 2,050 r.p.m., 125 m.p.h.; stalling speed (with flaps), 40 m.p.h.; rate of climb, 850 ft./min.; normal cruising range at 2,050 r.p.m., 620 miles; cruising range with extra tankage at 2,050 r.p.m., 910 miles; and price, (two-seater) £1,250, (three-seater) £1,325.

Of interest primarily for elementary Service training, the Miles Magister is, nevertheless, very suitable for civil, school and club use, and is used by the Straight Corporation group of clubs. It is described, with the necessary data, among the military aircraft elsewhere in this issue.

Makers:—Phillips and Powis Aircraft, Ltd., Woodley Aerodrome, Reading, Berks (Sonning 2211).

TIPSY

MANY years ago Mr. E. O. Tips, of the Belgian Fairey Company, designed, largely for his own amusement, a little single-seater which gave a remarkable performance for its power. More recently he has designed a side-by-side two-seater on somewhat similar lines, and the first of these, built in Belgium, was demonstrated over here some eighteen months ago. Since then the Tipsy Aircraft Company has been formed in this country and the original design has been modified by the British Fairey Company to suit our own normal and aerobatic C. of A. requirements.

Production two-seaters are now coming through from the Hanworth factory, and the type is intended to fill the gap which at present exists in the range of machines in the light-weight category of the C.A.G. Scheme.

In its construction, which is of stressed plywood, special attention has been paid both to ease and quickness of manufacture, and simplicity of maintenance. In order to make the machine rather more suitable for *ab initio* work the modifications to the original design have included an increased dihedral with a pronounced wing-tip wash-out, while the elevator control has been limited so that it should be practically impossible for the novice to get the machine into any dangerous fore-and-aft attitude. This limitation has also simplified the process of landing, which may be considered as being almost automatic. The new Tipsy is fitted, too, with small-area split flaps which, while reducing the landing speed to a small extent, are primarily valuable as a means of steepening and adjusting the approach angle. The engine at present fitted to the production Tipsy is a Walter Mikron, and this Czechoslovakian engine may very shortly be in production under licence in this country.

An unusual view of the Tipsy two-seater. In production form this machine is stressed for aerobatic work and is comfortably inside the upper weight limit of the light C.A.G. class.

The general layout in the slightly staggered side-by-side-seater cockpit has been designed with the idea of simplifying the process of flying so far as possible. Apart from the usual stick (centrally placed between the two seats), rudder pedals and throttle, the only other control of flying interest is the ingenious pull-on lever for operating the flaps. In addition, there is a tail-trimming lever, but this hardly needs to be touched in circuit flying, and is fitted only to make long

Latest of the Miles private-owner types, the Monarch, shown here in three-seater form. It has "glide control" flap gear and cruises at 125 m.p.h.

cross-country trips more comfortable.

The Tipsy has a C. of A. in the normal category, but by this time it is possible that an aerobatic version of the certificate will have been obtained.

TIPSY data:—Span, 31ft. 2in.; length, 22ft.; all-up weight, 1,074 lb.; weight empty, 618 lb.; maximum speed, 110 m.p.h.; cruising speed (2,600 r.p.m.), 100 m.p.h.; stalling speed, 37 m.p.h.; rate of climb, 650 ft./min.; range at cruising speed, 350 miles; and price, £675.

Makers:—Tipsy Aircraft Co., Ltd., London Air Park, Hanworth, Middlesex. (*Feltham* 2694.)

The Wicko monoplane, which is a side-by-side cabin two-seater, has been designed for club or private-owner use. It is fully aerobatic.

WICKO

AFTER initially interesting experiments with a machine powered by a specially modified Ford engine, the Foster Wikner Aircraft Company settled down at Southampton two years ago to the production of a machine with a conventional power unit. The Wicko monoplane has been designed with the idea of providing a machine which is not only cheap to make and to maintain, but which has a very fair performance and is amply strong for all training work. The machine is fitted with a Gipsy Major engine and is constructed on not-too-conventional lines.

For instance, the wing, though strut-braced, has a ply-skin covering to take drag and incidental loads. The fuselage is of the ply-covered box-type, but here, again, an interesting method has been evolved of reducing the usual jigging complications. Each of the four sections making the box is built up with its own half-longerons, and these are glued together so that the halves become single laminated wholes.

In layout the Wicko, which is a side-by-side cabin two-seater high-wing machine, tends to possess the best features of past and present design. The high-wing layout gives an adequate measure of stability and safety at the stall, while large-area contour-changing flaps are fitted to the trailing edge. The machine is very robustly constructed, and Mr. G. N. Wikner, who is both the designer and the test pilot, had no difficulty in obtaining a C. of A. in the aerobatic category. He is, incidentally, a designer of quite long standing, though his earlier machines saw the light of day in Australia.

From the pilot's point of view the Wicko possesses a number of outstanding characteristics, not the least important of which is a stall of an unusually innocuous nature, with the flaps either up or down.

WICKO data:—Span, 31ft. 6in.; length, 23ft. 3in.; weight empty, 1,255 lb.; all-up weight, 2,000 lb.; wing-loading, 13 lb./sq. ft.; power-loading, 15.3 lb./h.p.; maximum speed, 140 m.p.h.; cruising speed, 122 m.p.h.; landing speed, 45 m.p.h.; range, 500 miles; and price, £895.

Makers:—Foster Wikner Aircraft Co., Ltd., Municipal Airport, Southampton (*Eastleigh* 8738); *and Colin Street, Bromley-by-Bow* (*East* 5020).

ROTATING-WING AIRCRAFT

A Temporary Hold-up in Production

NO special significance should be attached to the fact that at the present moment no rotating-wing aircraft suitable for the private owner is in production. It just so happens that the firms which have specialised on this type of machine are in process of changing over to the next type, which in most cases will represent a very marked departure from previous models.

Unfortunately it is not possible to publish details, but it may be stated that not only are gyroplanes with improved performance and better control being developed, but the next year or so is likely to see the introduction of helicopters. In Germany the Focke-Achgelis firm has shown that controllability can be obtained, although from a performance point of view the twin-rotor helicopter, with its drag-producing outriggers, appears to be somewhat handicapped. In this country designs are in existence which promise to give full controllability with a single rotor, and their generally clean aerodynamic design should make them comparable with fixed-wing aircraft in the matter of performance. They will, of course, have the added advantage of being capable of hovering flight, and of vertical ascent and descent when desired.

Great Britain has contributed greatly to the evolution of rotating-wing aircraft, and there is no cause for viewing the future with alarm. Our position is likely to be maintained.

Primarily concerned in this connection are three firms—the Cierva Autogiro Co., Ltd. (London Air Park, Feltham, Middlesex)—this firm is also interested in the Weir Autogiro; the A.R. III Construction Co., Ltd., of Feltham, Middlesex; and Kay Gyroplanes, Ltd., Southampton Municipal Airport, Eastleigh, Hants.

VICKERS REORGANISATION

LAST week we briefly announced an impending change of considerable importance in the organisation of the Vickers group of companies.

Now comes the announcement, by the Air Ministry, that arrangements have been concluded between the Air Ministry and Vickers-Armstrong, Ltd., for the creation, with the aid of their whole organisation, of a wide-spread sub-contracting system to be employed on the manufacture of aircraft. This system will feed component parts for final assembly into a new central factory to be controlled by Vickers. The necessary sub-contracts are already being placed in connection with a large initial order, whilst active measures are in train for the provision of the central factory.

Vickers (Aviation), Ltd., announce that Mr. Alex. Dunbar, director and general manager of the English Steel Corporation, Vickers Works, Sheffield, is leaving Sheffield to take up a new appointment as chief of the aviation side of Vickers-Armstrongs, Ltd. Mr. Dunbar has served in every branch of the Vickers group, and for nearly seven years he was connected with the aviation side.

Mr. Dunbar is a director of Firth-Vickers Stainless Steels, Ltd., Industrial Steels, Ltd., Darlington Forge, Ltd., Oughtibridge Silica Firebrick Co., Ltd., the Steel Manufacturers' Nickel Syndicate, Ltd., and other companies. It is understood that he will retain an active connection with the administration of English Steel Corporation.

SERVICE AVIATION

Royal Air Force and Official Announcements :

Fleet Air Arm News : Military Aviation Abroad

Ansons for Abu Sueir

FIVE Anson general reconnaissance monoplanes left Thorney Island last Tuesday to join No. 4 F.T.S. Abu Sueir, Middle East Command. Another five will leave in a few days. All will be used for training.

Reunion of No. 2 Wing, R.N.A.S.

ON Wednesday last week No. 2 Wing of the Royal Naval Air Service, which served in the Eastern Mediterranean and on the seaplane carriers *Ark Royal* and *Canning* during the Great War, held its fourth reunion dinner, at Lysbeth Hall, Soho Square, London. Wing Cdr. P. A. Shepherd was in the chair, the President, Major K. S. Savory, D.S.O., was present, and there was a gathering of nearly two hundred members of all ranks. The first dinner consisted of about forty, but in four years the event has grown amazingly in popularity. Old times were recalled, old photographs of quaint machines on Imbros and Mudros were produced and handed round, and everything went merrily. One group taken at Sheerness showed Bert Hinkler as a mechanic. Stories recalled how Sir John Alcock was first a warrant officer and afterwards an officer in the Wing, and how he and some of those present forced-landed in a Handley Page and were taken prisoners by the Turks. Great enthusiasm was evoked by the tale of how Major Savory flew that same Handley Page out from England, a flight which, if it had been done in peace would have set the Thames (and Fleet Street) on fire.

It was most gratifying to note how prosperous the old members of this Wing seemed to be, and to learn that hardly anyone who had been in the Wing required the help which their old comrades were quite ready to extend. That Wing was composed of good men.

Annual Dinner

THE 20th annual reunion of the ship's company of H.M.S. *Engadine* will be held at The Princess Louise, 208, High Holborn, London, W.C.1, on Saturday, November 12. Tickets from A. B. Ward, 19, Cursitor Street, London, E.C.4.

Armistice Ceremony

THE Chief of the Air Staff, Air Chief Marshal Sir Cyril Newall, G.C.B., C.M.G., C.B.E., A.M., will lay the Royal Air Force wreath on the Royal Air Force War Memorial, Victoria Embankment, London, at 11 a.m. on Sunday, November 6.

The Members of the Comrades Royal Air Forces Association and of the Women's Royal Air Force Old Comrades Association, together with the Royal Air Force Band and a Detachment of R.A.F. personnel, will be drawn up in square across the road in front of the Memorial for inspection by the Chief of the Air Staff at 10.50 a..m

A short service will follow, conducted by the Chaplain-in-Chief of the Royal Air Force, the Rev. J. R. Walkey, C.B.E., M.A., K.H.C., and will terminate with the Last Post, which will mark the beginning of a two minutes' silence before 11 a.m.

At 11 a.m. the Chief of the Air Staff will lay the R.A.F. wreath and he will be followed by the Representatives of the Dominions and the Associations. The Réveillé will then be sounded.

Supply Dropping

EVERYONE who has seen a Hendon Display is familiar with the small canisters and parachutes used for dropping supplies to ground troops. Only small quantities can be dropped at one time, so during the past summer experiments were made in dropping various types of stores in bulk from a Valentia, without using parachutes. The aeroplane flew as slowly as possible into the wind at Turnhouse, and as low as possible. Tinned beef (the familiar "bully"), was only 10 per cent. damaged, biscuits were broken but were eatable, tea and sugar could be dropped without damage if properly wrapped. It was found that one Valentia could thus drop enough food on one trip to supply 980 men for 24 hours. Condensed milk, jam, margarine, petrol and oil had to be dropped by parachute.

Flying Accidents

THE Air Ministry regrets to announce the following accidents:—Flt. Lt. Rowan Sydney Howe, Sgt. Jack William Walkling and Sgt. Norman Percy Smith, lost their lives in a collision in the air which occurred at Waldenlade on October 15 between two aircraft of No. 23 Elementary and Reserve Flying Training School, Rochester, Kent. Flt. Lt. Howe and Sgt. Walkling were the occupants of one of the aircraft and Sgt. Smith was the pilot and sole occupant of the other.

A.P/O. Lionel Reed (flying solo) lost his life in an accident which occurred near Kantara on October 17 to an aircraft of No. 33 (Fighter) Squadron, Ismailia, Egypt.

A collision in the air occurred at Great Dunmow, Essex, on October 18, between two aircraft of No. 148 (Bomber) Squadron, Stradishall, Newmarket, Suffolk, in which the following occupants lost their lives: P/O. Eric Chamberlain Wheelwright, Sgt. Reginald Prosser, Sgt. Wilfred Courtney Cunnington, A./Sgt. James Crane Irwin, Sgt. Eric Mark Walker, and A/C.2 Thomas Moore Boyd. P/O. Wheelwright and Sgt. Prosser were the pilots

Royal Air Force Gazette

Princess Mary's Royal Air Force Nursing Service

The following Staff Nurses are promoted to the rank of Sister on the dates stated:—Miss B. J. Hutchinson (October 1); Miss D. K. Pye (October 5).

Royal Air Force Reserve

General Duties Branch

Flt. Lt. J. Ramsden relinquishes his commission on appointment to the Air Branch of the Royal Navy (September 26); Flt. Lt. C. F. Newcombe relinquishes his commission on appointment to a commission in the Royal Canadian Air Force Reserve of Officers (May 1).

Royal Air Force Volunteer Reserve

Medical Branch

The following are granted commissions as Flt. Lt. (October 18):—R. W. Durand, M.R.C.S., L.R.C.P.; G. E. M. Turner, M.R.C.S., L.R.C.P.

Auxiliary Air Force

General Duties Branch

No. 601 (COUNTY OF LONDON) (FIGHTER) SQUADRON.—Flt. Lt. A. C. W. Norman relinquishes his commission (August 25).

Auxiliary Air Force Reserve

General Duties Branch

A. C. W. Norman is granted a commission as Flight Lieutenant in Class A (August 25).

Royal Air Force

General Duties Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—P. D. Holder (Acting Flt. Lt.) (seny. December 3, 1935) (September 3); G. T. Gilbert (Acting Flt. Lt.) (October 4); P. Fleming (October 16).

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated:—C. E. R. Tait (September 9); R. N. Wardell, T. M. Evans, J. Riley (September 15); G. E. Horne, V. Ray (September 21)

Lt. J. M. Bruen, R.N., Flt. Lt., R.A.F., ceases to be attached to the Royal Air Force with effect from August 15 on return to Naval duty, and is reattached to the Royal Air Force as a Flt. Lt. with effect from August 17 with seny. of January 1; Neil McI. Kemp, R.N., Flt. Lt., R.A.F., ceases to be attached to the Royal Air Force with effect from August 22 on return to Naval duty, and is reattached to the R.A.F. as a Flt. Lt. with effect from September 25 and with seny. of July 1, 1937 (substituted for notification in *Gazette* of September 13); Flt. Lt. F. L. P. Henzell is placed on the retired list on account of ill-health (September 1); Flt. Lt. F. A. Wardell is transferred to the Reserve, Class A (October 7).

Medical Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant on the date stated:—R. L. Scott, M.B., Ch.B. (seny. September 6, 1937) (September 6); F. G. Ryan, L.R.C.P., and S. (September 6); H. V. Thomas, L.R.C.P. and S. (September 20).

Chaplains Branch

The Rev. J. Lee is granted a short service commission with the relative rank of Squadron Leader (October 4).

Memoranda

The permission granted to C. A. Hutchins to retain the rank of 2nd Lt. is withdrawn on enlistment in the Territorial Army (March 31); the permission granted to M. L. Metcalfe to retain the rank of 2nd Lt. is withdrawn (August 17).

Owing to the greatly increased length of these lists, as a result of R.A.F. expansion, ranks are confined to those of Flight Lieutenant and above

COMMERCIAL AVIATION

END OF THE SEASON: Last week the Blohm and Voss seaplane *Nordstern* made the season's final Atlantic crossing.

THE WEEK AT CROYDON

"A. Viator," in his Transport Commentary, Deals with Parking Perfection, Verks and Bricques, Noteworthy Arrivals and the Balloon Business

I AM often amazed at the accuracy with which big machines are taxied in a sweeping curve to an exact position on the tarmac. The cabin door is brought exactly opposite the entrance door to Customs, and this means that the wing tip swoops to within a foot or so of the terminal block. Feeble though the construction of that building is, it is, nevertheless, as the contractor proudly boasts, a trifle stronger than the wing of the average aeroplane.

But more astonishing still is the wizard precision with which the tractor people will swing a machine like *Heracles* away from the building while one wing tip is within inches of the windows of the Met. Office. I saw one the other night so close to that particular window that if anyone had rung up for a weather report there would have been an accident. If a junior assistant rain-maker had peered forth from the window the port wing of the machine would have scraped off his prehensile nose. His report would then have been, "Severe electrical disturbances, shooting stars at times, thunderbolts later, visibility nil, further outlook darn dangerous; window broken, going home."

Notability

Germany's Number One sportsman, General Reichsleiter Adolf Huhnlein, arrived at Croydon one day last week in a special Junkers Ju.52 from Berlin—but via Paris. He came for the motor racing at Donington Park, and also to see the Motor Exhibition. He is, I am told, so full of energy that he has various forms of wheeled sport paraded for drill before breakfast.

Everybody seems delighted with the first of the Ensigns, but one must not expect the impossible, as one of the Press people did when he wrote that the pilot never more than half-opened his throttles, so that the "top cruising speed of 210 m.p.h. was not reached." It wasn't that, laddie; the throttles were not only open, but half out of their sockets. The reason we did not cruise at 210 m.p.h. was because the brakes were on.

Works and bricks continue to march and counter-march, followed, and at times preceded by (but that's when they start walking in circles and overtake themselves), the official standard-bearer in the rubber boots, with his little red and white flag. This Valse Triste Verks et Bricques (Opus O) includes sudden grovellings on hands and knees at uncertain intervals, as though the jolly dancers suspected that phantom aircraft might be landing low over their devoted bowler hats. It is pleasant to watch, and it is thought that it will soon cease—when there are no more mushrooms.

The arrival at about noon on Saturday of a little-heralded Douglas D.C.2 belonging to C.L.S. caught the Press boys napping. Not a single camera was focused on Dr. Benes, who stepped from the machine and swiftly departed by private car for an unknown address. I saw him arrive with his wife, and very glad I was to see him put foot on soil where a man may say what he believes and where, I trust, he will be an honoured guest so long as he cares to stay with us.

Last week Miss Laurie Steele, the K.L.M. Australian air hostess, was very much in the news and was extensively photographed, interviewed by lady journalists and all the rest, because she happens to be the very first British air hostess to fly regularly on a foreign line. One imaginative writer described her as a "golden-haired Sydney girl," but the guess was a poor one, for she is a dark-haired, dark-eyed brunette. I doubt if she will change her colour scheme to oblige the newspaper concerned.

Her main job on the European sectors of K.L.M. is to look after passengers bound for Australia.

Away They Go

I have come to believe pretty firmly that there is no fun whatsoever for the balloon blokes unless they can do their stuff athwart an air route. Even when compelled recently to carry out their barrage business on the wrong side of Croydon they managed to loose one, at least, of their monsters to dance uncertainly over the North Sea. The next move is to tether a balloon to a motor vessel, or vice versa, and place it pretty well on the air routes, playing a searchlight on it at night, or on to the cloud which so cunningly conceals it. By day the cloud will look just like any other and therein lies the jest, of a type well calculated to arouse mirth in the Mess. Let us hope this matter has been worked out by those concerned, otherwise we may meet H.M. motor boat *Skyrocket* at 10,000ft., thus living up to its name, the balloon having taken charge of the situation, and urged on by a brisk gale.

Somebody is said to have met recently a simple-minded brass-hat connected with barrages. He had a scheme, they say, to practice coastal barrages all round the place. His idea was to do it at night so as not to interfere with the commercial flying. He had never heard of the various night mail and night freight services.

Talking of uncontrolled flights, I expect to see one of Imperial Airways' smart page-boys go parachuting upwards one of these days on the handle of one of the huge red and black umbrellas which they use to protect passengers in wet weather. It only needs the thoughtless (or thoughtful) opening up of throttles by some nicely positioned pilot in a large machine and little Willie's next stop would be the gas works away past Waddon Bridge.

As a matter of fact, the umbrellas are a good idea, and their shelter is much appreciated by lady passengers, but is it not time we ceased to be so painfully primitive in these matters? Why, even the railway people provide shelter for their passengers from rain, hail and red-hot coke.

A. VIATOR.

Commercial Aviation

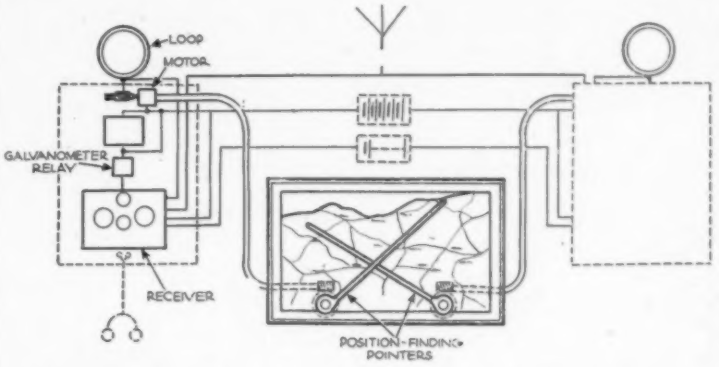
AUTOMATIC FIX

Continuous Position Indication : An Ingenious Combination of D/F Receivers

THE idea of developing a compact little instrument which will show on a map a continuous and reasonably accurate position has always been something of a dream of the future among those pilots who fly, because they must, in all weathers. Such an instrument might appear to have those impossibly magical qualities demanded, say, of that equally wished-for device in which the pilot may see before him a picture of the aerodrome during a trick-weather approach.

In fact, there is nothing either impossible, or even very new, about the means by which such an automatic position indicator could, in reality, be made. All one needs is a pair of rotating loops and two receivers, each of which is tuned in to a known transmitting station. But nobody appears, until now, to have put the standard components together to give the magical results.

Some time ago Mr. O. G. E. Roberts, who is now with the Straight Corporation, conceived the idea, which has been developed and made to work by Mr. J. A. McGillivray, the chief wireless instructor at Air Service Training. In its experimental form the equipment may appear to be largely of academic interest, since it is somewhat heavy, and the various items cover quite a wide area in the radio section at Hamble. There is, however, no reason at all why it should not so be modified that it could be used in any medium- or large-sized aeroplane. At present the weight of the entire equipment is in the region of 100 lb., but means can immediately be seen by which this could, even now, be reduced to something like 60 lb.



The position-finder equipment shown in diagrammatical form. The arrangement of the map and position-marking pointers is, in this case, purely academic.

Working Principles

The principle behind the Roberts-McGillivray position finder is, as already suggested, an extremely simple one. The foundation of the idea might be visualised as a scheme by which two loop aerials are carried on the wing tips of a machine, each of them being tuned in to a particular broadcast station, and the difference in the two readings providing the fix. This is obviously an impossible arrangement, since the base of the triangle would be so small that each of the loops would give exactly the same reading. Instead, two loops, which would be conveniently placed in the fuselage of the machine, are tuned in to different broadcast stations, and the bearings obtained are automatically laid off on a chart.

The workings of the direction-finding aerial are sufficiently well known, but in order to explain the working of the position finder as a whole it will be better to describe one of the two similar D/F units used. If a wireless receiver is operated from a loop or a frame aerial, then the signal strength depends on the angle between the plane of the loop and the direction from which this signal is, so to speak, approaching. When the plane is in line with the direction the signal strength is at a maximum; when it is at right angles, then this strength is at a minimum—and, theoretically, is zero. The receiver is connected to the loop and also to a fixed aerial to give "sense" or positive direction.

In the case of the position finder, telephones are used for station identification, and an electric relay is also employed in the output circuit of the receiver. This relay is, in fact, a very sensitive electrically operated switch, and when the current flows from the receiver the relay cuts in. If, however, the loop is at right angles to the signal source there will be no output current, and the relay will be out of action.

The purpose of this relay is to connect a battery to an electric motor, which, through suitable reduction gearing, turns the loop. When the receiver is tuned in to a station the output current from the receiver causes the relay to cut in, and the motor continues to run, turning the loop as long as there is any output. As soon as the loop is located in the "minimum" position the motor automatically stops, and the loop has, therefore, been lined up.

Mechanically connected to the motor is a long, flexible shaft, which carries at its end further reduction gearing in the form of a worm and worm wheel. The worm wheel carried a pointer, which turns as the loop turns and through the same number of degrees. The pivot of this wheel is placed on a map at a position equivalent to that of the transmitting station which is being used, and the pointer, if correctly adjusted, will then indicate the actual bearing of the receiver in relation to the transmitter. As the receiver is moved the relay will again cut in, and the motor will turn the loop with the pointer until the signal is washed out, when the stationary pointer will indicate the required bearing of the receiver in relation to the transmitter.

It is obvious that if two such automatic bearing indicators are used at the same time, and if both are showing bearings from different stations on the same map, then the point of intersection of the two arms will indicate the position of the receiving equipment. This automatic position-finding capacity holds good for any predetermined set course of the machine in which the receivers are carried.

Practical Experiments

In its experimental form the position finder has been in use at Hamble for some weeks, and the results have been found to be accurate enough. When we saw it, the position shown, while using various combination pairs, including Droitwich, London Regional, Western Regional, and Radio Paris, only once varied within a couple of miles of Hamble. There was generally a certain amount of hunting by one or other of the needles as the loop attempted to settle down on the true minimum, but this hunting was only momentarily changing the resultant position by a matter of a few miles, and such an error would not be of any great consequence in normal operation.

The apparatus is, of course, subject to all D/F errors, but it is probable that these can be reduced to small values by the suitable modification and application of well-known principles. Of these errors two are most important—night and quadrantal effects. There should be no difficulty about dealing with the second of these, but night error cannot at present be cured.

Of the position-finder's value in production form it is difficult to be absolutely certain. A fix obtained by two

Commercial Aviation

loop aerials carried by an aeroplane can never be a very accurate one, but the experiments have at least shown that, even with the present equipment, the position is near enough to be useful within the limits demanded during a long period of blind flying. One presupposes the existence of a D/F station and/or, better still, a blind approach system at the terminal aerodrome, and the device merely acts as an important assistance to normal dead-reckoning calculations.

Now that automatic pilots are part of the standard equipment in nearly all large transport aeroplanes, the possibility of linking the position finder to such a pilot must also be considered, and an idea on these lines is being developed. There are always endless reasons for research work in any combination of radio equipment and automatic pilots. The more accurately automatic the flying of a transport or military machine can be, the less work there is for the pilot, and the more likely he is to be fit to cope with the really difficult business of the blind approach at the end of a journey. In flying, the personal element is still the most fruitful cause of accidents, and anything which can be developed to relieve the pilot of some of his work has a special importance.

It might be argued that the really large commercial machines which can reasonably be expected to carry the necessary equipment already carry a wireless operator who can obtain bearings and plot fixes from ground stations, which by their very nature will provide better results. But there should certainly in the civil world be a use for the device on medium-sized commercial machines in which all the navigation and R/T work is carried out by an unassisted pilot.

More important still are the Service pilots who are not at present trained to make the best use of ground wireless facilities. The idea of having a straightforward instrument, on or near the dashboard, which will show a fairly accurate position at any time, will appeal strongly to the military pilot who is likely to be much busied by other things.

West Indian Survey

ONE of the Lockheed Fourteens used by K.L.M. in the West Indies recently completed an experimental flight from Curaçao, via Trinidad, to Paramaribo, the capital of Dutch Guiana. During this preliminary flight several Government officials were taken on a special trip along the coast and into the interior of the country.

The return journey from Paramaribo to Curaçao, a distance of approximately 1,050 miles, was covered non-stop in 5¼ hours at an average speed of 191 m.p.h. In the ordinary way this trip can only be covered by steamer in a matter of seven days.

More than a thousand passengers were carried during September on K.L.M.'s West Indies routes, and the average number per month during the first eight months of the year was 723, showing an improvement of about 40 per cent. on the corresponding figure for the previous year. Altogether 6,800 passengers have travelled so far on the K.L.M. routes in South America.

Massacre in Battersea

VERY shortly passengers in Imperial Airways' flying boats will probably be able to detect a faint and not unpleasant odour, rather like the scent of Michaelmas daisies. Little will they suspect that this aroma spells death to disease-bearing insects which may have found their way inside the ship at some tropical port of call. In this way Imperial Airways hope to overcome the menace of disease infection by aircraft in various parts of the tropics.

One of the arch-conspirators in this respect is the malaria-carrying mosquito, of which there are several types. Normally the mosquito does not cause operating companies much trouble at aerodromes, provided the recommended precautions have been taken. Like fighter aircraft, the mosquito is strictly limited as regards range—few can undertake a flight of more than a quarter of a mile from their favourite pool of water. For obvious reasons, these precautions cannot be taken at flying-boat bases, and in view of this Imperial Airways have undertaken a great deal of research with a view to ridding their ships of this pest while in flight from one port of call to another.

Last week a demonstration was given at the Company's Experimental Production Section, Battersea, London, S.W., where, under the direction of Col. F. P. Mackie, C.S.I., O.B.E., and Mr. H. S. Crabtree, A.F.R.Ae.S., over 250 mosquitoes of the species *Culex* (a malarial-carrying type, supplied through the courtesy of the London School of Hygiene and Tropical Medicine) were put to death in a large room filled by some twenty people. The demonstration was arranged to prove that while the fumes given out by the special Phantomyst equipment were not in the least unpleasant, and, for that matter, scarcely noticeable, their lethal properties, so far as the mosquitoes were concerned, were astonishingly effective. Within eight minutes all the mosquitoes were killed. The insecticide used for this purpose is a distillation from pyrethrum, a small wild flower which grows in the South of England and on the sunny slopes of Kenya. Its properties have been known for some years, but only recently has it been possible to disseminate it into the atmosphere, effectively from a medical viewpoint, while in an aircraft actually in flight. The Phantomyst electrical disseminator is light and portable and can be left unattended in one cabin for ten or so minutes before carrying it into another. The vapour which emanates is not inflammable and does not harm either the passenger or the aircraft in any respect.

Newspapers to Jersey

TWO years ago Jersey Airways were commissioned by a group of London publishers to take newspapers from Southampton to Jersey every day during the summer, with the idea of catering for those readers who were on holiday. This early morning service was repeated during this season, but ceased to operate at the end of last month.

Following requests from residents who have got used to receiving their newspapers on the day of publication, a winter service has now been started, and machines leave Southampton Airport at 6 a.m., carrying approximately two tons each day in a couple of D.H. 86s. This service started last Monday.

Incidentally, the company's traffic figures for the first nine months of this year showed considerable increase on those for the corresponding period of the previous year. Altogether 81,923 passengers were carried—an increase of 2,518, or 8.56 per cent. Southampton was again the busiest centre, 17,617 passengers being handled there.

Atlantic Season

WITH the fast crossing made by the Blohm and Voss Ha 139b, *Nordstern*, from America to Europe on October 19, D.L.H.'s season of Atlantic flying ended.

During the 1936 experiments the company's machines flew a distance of 23,400 miles, and the times for the flights between Horta in the Azores and New York varied between 22 hr. 12 min. and 13 hr. 32 min., giving average speeds between 119 m.p.h. in the east-west direction and 134 m.p.h. in the west-east direction. This year 88,000 miles were flown at average speeds in the same respective directions of 153 m.p.h. and 168 m.p.h. The company has been using the Blohm and Voss seaplanes exclusively.

Previous to the direct experimental flights across the North Atlantic, which were started in 1936, regular trips had been made since 1929 from the two Atlantic liners *Bremen* and *Europa*, whence mail seaplanes were catapulted a few hundred miles from the coast when nearing either New York or Southampton.

Baltic Extensions

THE Swedish Public Works Department have decided to spend a very large sum on the improvement of civil airports during the coming year. Those concerned in the plan are Bulltofta, Bromma (Stockholm), Torslanda (Gothenburg) and Norrkoping. At the same time night-flying beacons are to be installed on the Stockholm-Norrtalje and Malmö-Gothenburg routes, while blind-approach equipment is being installed at Torslanda.

In Finland extensions are also to be made to the Helsinki terminal, which was described in the issue of June 2, 1938.

Nearly 300 acres of ground are to be added to the landing area, and the permanent runways are to be completed. The north-south run, which is the principal one and is generally used for bad weather approaches, will eventually have 765 yards of paved surface. It may be remembered that Helsinki is one of the few, if not the only, airport in Europe to be equipped with two separate blind approach systems, the QDMs for which are at right angles to one another.

Last year, incidentally, the Finnish operating company, Aero O/Y, flew something like 80,000 miles on internal services, using D.H. Rapides, and these services have been maintained with a regularity of 99.55 per cent. The bulk of air freight has increased very considerably chiefly because of the tendency of publishers to send their newspapers to the provinces by air.